Patric R. O'Brien
Senior Counsel

February 15, 2012

VIA ELECTRONIC FILING

Honorable Jaclyn A. Brilling
Secretary
New York State Public Service Commission
Three Empire State Plaza
Albany, New York 12223-1350

Re: Case 04-M-0159 – Proceeding on Motion of the Commission to Examine the Safety of Electric Transmission and Distribution Systems – 2011 ANNUAL REPORT

Dear Secretary Brilling:

Niagara Mohawk Power Corporation d/b/a National Grid submits for filing its *2011 Annual Stray Voltage Testing and Facility Inspection Report* in the above proceeding.

Should you have any questions or concerns, please do not hesitate to contact me. Thank you for your time and attention.

Respectfully submitted,

/s/Patric R. O'Brien
Patric R. O'Brien

Attachments

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State of New York
Public Service Commission

Case 04-M-0159

Niagara Mohawk Power Corporation
d/b/a National Grid

Stray Voltage Testing and Facility Inspection

2011 Annual Report

Report on the results of stray voltage testing and facility inspections
for the 12-month period ended December 31, 2011

February 15, 2012

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I. Background

The New York State Public Service Commission's ("Commission") Electric Safety Standards adopted on January 5, 2005 in Case 04-M-0159, with subsequent revisions issued on July 21, 2005, December 15, 2008, and July 21, 2010 (collectively referred to herein as the "Safety Standards" or "Order"), requires electric utilities in New York State to test annually all of their publicly accessible transmission and distribution facilities for stray voltage and to inspect their electric facilities every five years.

This report describes Niagara Mohawk Power Corporation's d/b/a National Grid ("National Grid" or "Company") stray voltage detection program and facility inspection program conducted for the 12-month period ended December 31, 2011.

II. Company Overview

National Grid provides electric service to approximately 1,600,000 customers in a service area of approximately 25,000 square miles in New York State. The Company operates an electric transmission and distribution system. For the stray voltage detection and facility inspection programs, National Grid divided its system into subprograms to schedule and track testing and inspections. The subprograms include the Company's (a) distribution overhead system, (b) distribution and transmission underground system, (c) streetlight system, (d) transmission system, and (e) substations.

a. Distribution Overhead System

National Grid's distribution overhead system consists of structures supporting circuits energized at voltages of up to 15kV. This system spans close to 32,000 miles and is made up of approximately 1,217,184 utility poles. Stray voltage testing of the distribution system is currently performed by contractors. Facility inspections of the distribution system are currently performed by the Company's internal workforce.

b. Distribution and Transmission Underground System

National Grid's distribution and transmission underground system is made up of facilities such as manholes, hand-holes, vaults, URD pad mounted transformers, and switchgear, among others. Fiberglass hand holes are exempt from stray voltage testing under the Safety Standards.[1] Stray voltage testing of the Company's underground system, which consists of approximately 95,159 assets, is currently performed by contractors. Facility inspections of the underground system, which consists of approximately 93,624 underground and 64,066 padmount assets, are currently performed by the Company's internal workforce.

[1] *See* July 21, 2005 Order, at 23; December 15, 2008 Order, at Appendix A, § 3(a).

c. Streetlight System

National Grid's streetlight system contains approximately 87,839 underground fed metallic streetlight standards and municipally-owned streetlights and traffic control devices. Overhead fed streetlights on wooden poles are included in the distribution overhead program and not counted within the streetlight program. For the underground fed metallic streetlight standards, contractors performed the stray voltage testing at night when the lights were operational. The traffic control stray voltage testing takes place in conjunction with the contractors' testing of the overhead and underground systems during the daytime hours. The streetlight facility inspections on Company-owned facilities take place during the day and are performed by an external workforce.

d. Transmission System

National Grid's transmission system, which includes the sub-transmission system, consists of structures that support circuits energized at voltages of 12 kV, 23kV, 34.5kV, 46kV, 69kV, 115kV, 230kV, and 345kV. The transmission system spans the entire State, is approximately 8,465 miles in length, and contains approximately 100,906 structures (wood and steel). Stray voltage testing on the transmission system, which consists of approximately 98,633 assets, is performed by contractors. In many instances, the most difficult part of testing a transmission tower is physically getting to the tower. Therefore, National Grid programmed its database and internal hand held computers to perform stray voltage testing on transmission structures while an employee was at the location for a visual inspection or the contractor was at the tower for a stray voltage test.

e. Substations

There are 908 substations in National Grid's New York State service territory. Stray voltage results for substation fences were collected internally by the operating group. The initial dataset identified 908 substation locations to be tested of which a number of these are customer-owned locations.

III. Stray Voltage Testing Program

During the calendar year ended December 31, 2011, National Grid conducted stray voltage testing of 100% of its publicly accessible transmission and distribution facilities that are capable of conducting electricity and 100% of all Company and non-Company owned metallic streetlights and traffic signals.

In addition, and in compliance with the Safety Standards, National Grid:

a. Immediately safeguarded and/or mitigated all voltage findings ≥ 1.0 volt. In instances where the stray voltage finding was determined to be caused by customer-owned equipment, the area was immediately made safe and the customer or responsible person associated with the premises was notified of the unsafe condition and the need for the

customer to arrange for a permanent repair. Voltage findings determined to be caused by a utility-owned facility were immediately safeguarded and/or mitigated. All permanent repairs were made within 45 days.

b. Tested all publicly accessible structures and sidewalks within a 30 foot radius of the electric facility or streetlight where there was a stray voltage finding ≥ 1. 0 volt.

c. Responded, investigated, and mitigated positive findings of shock incidents reported by the public.

All facilities that comprise National Grid transmission and distribution system were visited. Of the 1,527,557 facilities visited, 324,623 did not require stray voltage testing because: the facilities are wood utility poles that have no attached appurtenances capable of conducting electricity; their electrically conductive appurtenances are not accessible to the public (pre-wired wood); the facilities are enclosed in fiberglass (non-conductive materials); de-energized facilities; and/or the facilities are inaccessible to the public.

Inaccessible facilities include:

a. Locked Gate/Fence – Poles behind locked gates and fences that are not accessible to the public, *i.e.*, facilities located in fenced areas owned by other utilities, such as water companies.

b. Dangerous Grades – Poles located on cliffs and other dangerous grades are generally inaccessible to Company personnel and the general public and are approached only under urgent circumstances. The performance of stray voltage testing on these facilities would constitute an unacceptable risk to the employee.

c. Company Property – Poles located on Company property, such as substations, are accessible only to Company personnel and authorized contractors.

d. Vaults - Structures located inside buildings. These structures are accessible only to Company and building maintenance personnel.

e. Limited Access Highway Facilities – Structures located on highways and exit and entrance highway ramps. The performance of stray voltage testing on these structures would constitute an unacceptable risk to the employee.

As required by the Safety Standards, National Grid performed 3,019 miles of mobile testing system scans between January 1, 2011 and December 31, 2011. A summary of the results of the mobile testing scans is contained in Appendix 8, which is the original mobile scan report filed with the Commission on December 22, 2011.

IV. Facility Inspection Program

The Safety Standards require National Grid to visually inspect approximately 20% of its facilities annually, resulting in a five year inspection goal for all facilities to be inspected. The year ended December 31, 2011 was the second year of the Cycle 2 inspection program.

National Grid visually inspects its overhead distribution and transmission systems on a five-year cycle, from the ground, as prescribed by the Safety Standards.

In addition, National Grid also performs the following inspections, some of which are recurring on specific cycles, some of which are scheduled on an as-needed basis:

- Aerial Infrared – Helicopter based thermographic imaging of connections and equipment.
- Tower Footing – Embedded support structure that supports a transmission tower.
- Wood Pole – Inspection of the wood pole at and below the ground line.
- Aerial Patrols – Helicopter based visual examination of transmission facilities and equipment.
- Comprehensive Helicopter Patrol – A comprehensive methodical examination of all components comprising the transmission system by helicopter.

National Grid's ground-based visual inspection program is segmented into five categories: distribution facility inspection; underground facility inspections; streetlight inspections; transmission facility inspections; and substation inspections.[2] Each program is summarized by its associated procedure document. The inspections include visual inspections of the assets to determine if deficiencies exist. Deficiencies are captured by codes entered into handheld computers. Data is then downloaded for review and follow up work.

In accordance with the Safety Standards, National Grid uses the following severity levels to establish priority for repairs and scheduling:

a. Level I – Repair as soon as possible but not longer than one week. A Level I classification represents an actual or imminent safety hazard to the public or a serious and immediate threat to the delivery of power. Critical safety hazards present at the time of the inspection shall be guarded until the hazard is mitigated.

b. Level II – Repair within one year. A Level II classification represents conditions that are likely to fail prior to the next inspection cycle and represent a threat to safety and/or reliability should a failure occur prior to repair.

[3] Substation inspections are more complex than those performed on other facilities and differ in variety of ways including, but not limited to, inspection schedules, system through which inspection data is captured, and work prioritization (supervisory review determines work to be completed versus Levels I-IV), among others. Substation inspection procedure and protocols are provided in Attachment 15 (SMS 400.06.1 entitled "Substation V&O Inspection Standard" and SMP 400.06.2 entitled "Substation V&O Inspection Procedure)."

c. Level III – Repair within three years. A Level III classification represents conditions that do not present immediate safety or operational concerns and would likely have a minimal impact on the safe and reliable delivery of power should a failure occur prior to repair.

d. Level IV – A Level IV classification represents conditions found but repairs are not needed at this time. Level IV is used to track atypical conditions that do not require repair within a five year timeframe. This level should be used for future monitoring purposes and planning proactive maintenance activities.

In accordance with the Safety Standards, when a temporary repair is located during an inspection or is performed by the Company, best efforts are made to make a permanent repair of the facility within 90 days. Temporary repairs that remain on the system for more than 90 days are due to extraordinary circumstances, *i.e.,* storms, outage constraints, and usually require extensive repair activity. National Grid has compiled a list of exceptions of temporary repairs that still remain in place after the 90 day requirement. The list and justifications can be found in Appendix 5 of this report.

National Grid provides classroom and field training to personnel inspecting facilities per the Company's Electric Operating Procedures ("EOPs"). The classroom training covers topics including: EOPs, distribution maintenance inspection and elevated voltage testing training, Computapole handheld training, Computapole database training, distribution vegetation training, geographic information system training, feeder patrols training, and basic electricity training.

The Company provides new distribution inspectors with training upon hiring, with ongoing yearly refresher courses. As part of the refresher training, National Grid updates all training materials due for updates from the following year. Specifically, the updates are done yearly using relevant EOPs and Company standards that have been updated.

V. Company Facilities

National Grid has approximately 1,527,557 individual facilities that require testing for the presence of stray voltage and approximately 1,541,618 individual facilities that require a facility inspection. These facilities are broken down into the following five main categories:

a. Distribution Overhead – National Grid has approximately 1,217,184 distribution pole structures in its New York service territory. The Company's testing criterion for distribution overhead facilities involves testing all Company-owned or joint-owned wood poles with utility electrical facilities located on both public thoroughfares and customer property, including backyards or alleys. Stray voltage testing, which consists of approximately 1,245,018 assets, is performed on all wooden poles with metallic attachments, such as ground wires, ground rods, anchor guy wires, riser pipes, or any electrical equipment within reach of the general public. Distribution overhead facilities are included in both the stray voltage and facility inspection programs.

b. Distribution and Transmission Underground Facilities – National Grid has approximately 95,159 underground assets in its New York service territory that require stray voltage testing. The Company's testing criterion for underground facilities involves testing all subsurface structures, including above ground, pad-mounted structures. Included in the underground facilities are padmount switchgear cases, padmount transformer cases, electric utility manhole covers, submersible transformer covers, electric utility handhole covers, network vaults, and grates. These facilities are included in both the stray voltage and facility inspection programs. Inspections of the underground system involve approximately 93,624 underground and 64,066 padmount assets.

c. Streetlights and Traffic Signals – There are approximately 59,439 metal pole streetlights and approximately 28,400 traffic signals in National Grid's New York service territory that require stray voltage testing. The streetlight total includes Company-owned metal pole streetlights and municipal-owned metal pole streetlights to which the Company provides service. The testing criterion for streetlights and traffic signals involves testing all metal pole streetlights, traffic signals, and pedestrian crosswalk signals located on publicly accessible thoroughfares. Stray voltage testing of streetlights is performed at night while the fixtures are energized. Privately-owned light fixtures are not included in the stray voltage testing program, per the Safety Standards. All Company-owned streetlights are included in the facility inspection program.

d. Substation Fences - National Grid operates and maintains 908 substation facilities that are necessary for the operation of the electric grid. These substations are fenced in for security, as well as to ensure the safety of the general public. Substation fences are included in the stray voltage testing program.

e. Transmission Structures – There are approximately 100,906 individual poles/towers that comprise National Grid's transmission system in New York. The testing criteria for transmission structures involves testing all structures, guys, and down leads attached to the facilities. Transmission structures support circuit voltages of 23 kV and greater. Transmission poles with distribution underbuild are included in the transmission category.

VI. Annual Performance Targets

In compliance with the Safety Standards, National Grid met the annual performance target for stray voltage testing of 100% of electric facilities and streetlights for the calendar year ended December 31, 2011.

In addition, in compliance with the Safety Standards, National Grid met the yearly performance target for inspection of approximately 20% (i.e., 95% of the annual target of 20%, or 19%) of its electric facilities for the period ended December 31, 2011.

The results are summarized in the tables below.

Stray Voltage Testing Results

Elevated Voltage Testing Annual Summary			
Program	**Total Units**	**Units Completed**	**% Completed**
Distribution	1,245,018	1,245,018	100
Underground	95,159	95,159	100
Streetlights*	87,839	87,839	100
Transmission	98,633	98,633	100
Substation	908	908	100

*Note: Streetlights include traffic controls but exclude fiberglass standards.

Facility Inspection Program Results

Category	Total System Units	Units Completed as of 2011	Actual Inspected as of 2011
Overhead Distribution	1,217,184	246,005	20%
Overhead Transmission	100,906	27,148	26%
Underground	93,624	19,987	21%
Pad-mounted Transformers	64,066	12,846	20%
Streetlights	65,838	35,733	54%
TOTAL	1,541,618	341,719	22%

Inspection Performance Summary

Overhead Distribution Facilities

Inspection Year	Number of Overhead Distribution Structures Inspected	% of Overall System Inspected (Cumulative)
2010	232,604	19%
2011	246,005	20%

Overhead Transmission Facilities

Inspection Year	Number of Overhead Transmission Facilities Inspected	% of Overall System Inspected (Cumulative)
2010	20,369	21%
2011	27,148	26%

Underground Facilities

Inspection Year	Number of Underground Facilities Inspected	% of Overall System Inspected (Cumulative)
2010	17,624	20%
2011	19,987	21%

Padmount Transformers

Inspection Year	Number of Padmount Transformers Inspected	% of Overall System Inspected (Cumulative)
2010	10,619	17%
2011	12,846	20%

Streetlights

Inspection Year	Number of Streetlights Inspected	% of Overall System Inspected (Cumulative)
2010	5,200	8%
2011	35,733	54%

VII. Certifications

Pursuant to section 7 of Appendix A of the Safety Standards, the president or officer of each utility with direct responsibility for overseeing stray voltage testing and facility inspections shall provide an annual certification to the Commission that the utility has, to the best of his or her knowledge, exercised due diligence in carrying out a plan, including quality assurance, that is designed to meet the stray voltage testing and inspection requirements, and that the utility has:

- Tested all of its publicly accessible electric facilities and streetlights, and
- Inspected the requisite number of electric facilities.

The certifications are attached as Appendix 18 to this report.

VIII. Analysis of Causes of Findings and Stray Voltage

The Safety Standards require the electric utilities to perform an inventory on all stray voltage findings and report on the number of these findings each year. Section 1(f) of the December 15, 2008 Order defines a finding as "[a]ny confirmed voltage reading on an electric facility or streetlight greater than or equal to 1 volt measured using a volt meter and 500 ohm shunt resistor." Section 1(c) defines stray voltage as "[v]oltage conditions on electric facilities that should not ordinarily exist. These conditions may be due to one or more factors, including, but not limited to, damaged cables, deteriorated, frayed, or missing insulation, improper maintenance, or improper installation." Utilities are required to report on all findings whether or not the voltage is normal to the electric system.

National Grid identified 559 instances of stray voltage during the stray voltage testing program in 2011. These voltages resulted from a variety of conditions including: deterioration of conductors; age of equipment; exposure to the elements; and various customer related issues. A majority (236) of stray voltage conditions identified were on distribution facilities. The ground connection on distribution facilities was the leading cause of stray voltage findings.

The following table contains a breakdown of the causes of stray voltage findings identified through the Company's 2011 manual testing effort. National Grid has repaired and/or mitigated all findings that were determined to be hazardous. Mobile testing findings are addressed in the Mobile Stray Voltage Testing Report attached as Appendix 8.

Structure Type	Cause of Stray Voltage	Stray Voltages Found
Distribution	Info Missing	2
Distribution	Arrestor	1
Distribution	Cable & Ground	1
Distribution	Down Ground	28
Distribution	Equipment – Other	10
Distribution	Ground Connection	68
Distribution	Guy	43
Distribution	Induce Voltage	38
Distribution	Insulator	1
Distribution	Lamp Wiring	2
Distribution	Neutral	5
Distribution	None Required	26
Distribution	Remade All Connections	2
Distribution	Customer Problem	9
Underground	Ground Connection	1
Underground	None Required	2
Underground	Poor Insulation	1
Underground	Customer Problem	1
Street Lights – Traffic Signals	Cable & Ground	7
Street Lights – Traffic Signals	Cable Feed	4
Street Lights – Traffic Signals	Ground Connection	23
Street Lights – Traffic Signals	Insulator	2

Street Lights – Traffic Signals	Lamp Wiring	5
Street Lights – Traffic Signals	Luminaire Change	4
Street Lights – Traffic Signals	Neutral	84
Street Lights – Traffic Signals	None Required	12
Street Lights – Traffic Signals	Remade All Connections	18
Street Lights – Traffic Signals	Customer Problem	5
Transmission	Info Missing	36
Transmission	Cable & Ground	1
Transmission	Down Ground	4
Transmission	Equipment Other	5
Transmission	Ground Connection	19
Transmission	Guy	10
Transmission	Induce Voltage	6
Transmission	Insulator	2
Transmission	None Required	8
TOTAL		496

In accordance with the Safety Standards, when National Grid discovered a finding on an electric facility or streetlight during stray voltage testing, the Company tested all publicly accessible structures and sidewalks within a minimum 30 foot radius of the electric facility or streetlight. National Grid did not identify any additional findings associated with the initial test structure as a result of the 30-foot radius testing.

The University of Buffalo ("UB") has been working with National Grid to investigate stray voltage issues related to the street lighting system in the greater Buffalo area. UB reviewed industry practices as they relate to the identification and mitigation of stray voltage, along with the Company's testing methods utilized for the measurement of stray voltage. Based upon this review, UB developed specific recommendations on how National Grid can continue to remediate stray voltage findings in compliance with codes, orders, and industry practices. A report summarizing the research performed with recommendations is contained in the Company's Mobile Stray Voltage Testing Report, which is found in Appendix 8.

IX. Analysis of Inspection Results

Note: Total Number of Deficiencies may add up to more than the total Locations w/ Deficiencies due to deficiencies on multiple facilities at a single location.

Overhead Distribution Structures

Table of Locations with Deficiencies

Locations Inspected	Locations w/ Deficiencies	% Locations w/ Deficiencies
246,005	114,742	46%

Breakdown of Locations with Deficiencies

Priority Rating	Number of Deficiencies	% Deficiencies Found
1	371	0.18%
2	24,909	12.45%
3	18,071	9.03%
4	156,597	78.31%
Total:	199,948	100%

Overhead Transmission Facilities

Table of Locations with Deficiencies

Locations Inspected	Locations w/ Deficiencies	% Locations w/ Deficiencies
27,148	10,085	37%

Breakdown of Locations with Deficiencies

Priority Rating	Number of Deficiencies	% Deficiencies Found
1	25	0.16%
2	339	2.21%
3	2,574	16.84%
4	12,342	80.77%
Total:	15,280	100%

Underground Facilities

Table of Locations with Deficiencies

Locations Inspected	Locations w/ Deficiencies	% Locations w/ Deficiencies
19,987	7,630	38%

Breakdown of Locations with Deficiencies

Priority Rating	Number of Deficiencies	% Deficiencies Found
1	70	0.85%
2	1,756	21.57%
3	367	4.50%
4	5,947	73.05%
Total:	8,140	100%

Pad-mount Transformers

Table of Locations with Deficiencies

Locations Inspected	Locations w/ Deficiencies	% Locations w/ Deficiencies
12,846	2,314	18%

Breakdown of Locations with Deficiencies

Priority Rating	Number of Deficiencies	% Deficiencies Found
1	23	0.24%
2	342	3.68%
3	1,046	11.28%
4	7,858	84.77%
Total:	9,269	100%

Streetlights

Table of Locations with Deficiencies

Locations Inspected	Locations w/ Deficiencies	% Locations w/ Deficiencies
35,733	10,375	29%

Breakdown of Locations with Deficiencies

Priority Rating	Number of Deficiencies	% Deficiencies Found
1	1	0.004%
2	719	3.01%
3	13	0.05%
4	23,093	96.92%
Total:	23,826	100%

In 2011, National Grid identified an overall total of 256,463 deficiencies:

- Priority Rating 1 Total = 490, or 0.19% of the overall total.
- Priority Rating 2 Total = 28,065, or 10.94% of the overall total.
- Priority Rating 3 Total = 22,071, or 8.60% of the overall total.
- Priority Rating 4 Total = 205,837 (inventory), or 80.25% of the overall total.

X. Quality Assurance

A. Asset Inspection Program ("IM")

National Grid's Asset Inspection Program is comprised of three separate process steps:

- The conducting of initial asset field inspections by the Company's internal Inspection workforce.
- Completion of a quality control audit program utilizing National Grid Inspection supervisors for the completion of randomly generated follow-up audits derived from the previously field inspected asset population.
- Completion of the required quality assurance Asset Inspection Program, which is conducted by a vendor independent to the field inspection and quality control process.

Quality Control ("QC") Audit Program - Asset Inspections

The National Grid Inspections Department supervisory staff performed QC asset audits on approximately 1,780 distribution, transmission, and sub-transmission assets that had been field inspected for maintenance during 2011. This program was designed to confirm and/or achieve a minimum confidence level of 95% compliance in consistency and adherence to procedures. The method used to confirm and/or achieve the required quality of asset inspection involved follow-up field audits by supervisory personnel through a random sample derived from the population of assets previously field inspected during calendar year 2011.

Each audit cycle would have one of the following outcomes:

a. **Confirmation of 95% compliance** – if a field inspector achieves 95% compliancy, they would continue to be audited only on a monthly cycle.
b. **Additional random samples are required** – if a field inspector fails to achieve 95% compliancy, they would continue to be audited on a weekly basis until the 95% compliancy is reached.

An audit was determined to be passing only if there was a correlation between the results of the inspection and those of the audit. The combination of maintenance codes, levels, and quantities were examined during the audit.

Based upon the accrued QC audit data provided by the Company's Inspections Department, the 2011 QC Program achieved an overall rating of 98.98%.

Quality Assurance ("QA") Audit Program – Asset Inspections

National Grid enlisted the support of a vendor to gather data for the QA Program. The QA Program and vendor operated under the direction of the Operations Performance function.

The QA Program methodology involved performing an additional QA inspection of randomly selected assets having been previously audited by supervisory personnel, with the intent of verifying previously

identified maintenance codes. This process captured "missed" maintenance codes, and noted instances of repairs when evident. In order to achieve a minimum 95% level of confidence, applicable to the entire population of inspection data and resulting random sample analysis, commonly applied statistical principles were utilized to conduct the assessment process.

2011 QA Program:

- The number (population) of assets inspected during the inspection year:
  - Distribution: 246,005(locations)
  - Transmission: 10,264
  - Sub-transmission: 16,884

- The sample size for the QC inspection: (Internal – National Grid Supervisory Staff)
  - Distribution 1485 assets (locations)
  - Transmission 148
  - Sub-Transmission 147

- The sample size for the QA inspection: (External – Premier LLC)
  - Distribution 850 assets (locations)
  - Transmission 100
  - Sub-Transmission 50

Defects Identified: The analysis of the QA/QC Program data is intended to identify the nature and magnitude of "defects" as applicable to the Inspection Program results. A "defect" was tallied when the QA/QC inspector added one or more Computapole Level 1, 2, or 3 codes at a single asset location that were not previously identified during the original field I&M inspection. For example, at a single distribution pole (asset location), if a QA/QC Inspector added one Level 2 code and one Level 3 code that were not listed on the spreadsheet of previously identified Computapole codes for that asset location, it was counted as one "defect."

The following table illustrates the "defects" identified through QA/QC process during calendar year 2011 (internal and outsourced assessments):

Asset Category	QA Inspection Locations	Defects Identified	Defects as % of QA Inspection Locations
Distribution	2335	Level 1 = 0 Level 2 = 18 Level 3 = 25 **Total = 43**	1.80%
Transmission	326	Level 1 = 1 Level 2 = 4 Level 3 =0 **Total = 5**	1.53%
Sub-Transmission	235	Level 1 = 0 Level 2 = 0 Level 3 = 0 **Total = 0**	0%
Totals	**2896**	**48**	**1.65%**

Results – QA Asset Inspections

National Grid has set a minimum threshold for inspection results accuracy compliance of 95%, meaning that in order for the data to be accepted as being a true indication of actual asset condition, 95% of asset locations and original field inspection findings must agree with QA/QC inspection results.

Based upon internal and external QA/QC survey results and the sample size and population of asset locations, the rate of accuracy involving completed QA inspections is as follows:

- Distribution: 98.2%
- Transmission: 98.47%
- Sub-Transmission:100.00%

Therefore, National Grid's Inspections Program is delivering greater than 95% accuracy of inspection results.

Analysis of Asset Inspections

Maintenance Code Deficiencies: The QA/QC analysis of the additional maintenance codes missed (defects) conducted by Premier LLC in 2011 concluded that the following three codes were missed repeatedly (44% of the entire defects sample size):

- Code 220 (Guy wire marker),
- Code 221 (Guy not to NESC code), and
- Code 284 (cut-out, non-porcelain).

Results – Repairs

Per the Safety Standards, the quality assurance program needs to verify that permanent repairs are made in response to inspections performed and the timeliness of the repair. The 2011 Inspection process yielded the following asset deficiencies and repair activity for Level 1, Level 2, and Level 3 priorities:

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process

Year	Priority Level / Repair Expected		Deficiencies Found (Total)	Repaired Within Required Time Frame	Repaired Past Required Due Date	Not Repaired and Not Due	Not Repaired – Overdue
2011							
	I	Within 1 week	490	484	6	0	0
	II	Within 1 year	28065	3016	0	25049	0
	III	Within 3 years	22071	647	0	21424	0

B. Elevated Voltage Inspection Program

Similar to National Grid's Asset Inspection Program, the Company's Elevated Voltage Inspection Program is comprised of three separate process steps:

- Initial field inspection process conducted through vendor field assessments.
- QC audit program utilizing related vendor supplied supervisors for the completion of randomly generated follow-up audits, which are derived from the field inspected asset population.
- Completion of the required QA Asset Inspection Program, which is conducted by a vendor independent to the field inspection and QC process.

The QA/QC Programs require an overall minimum confidence level of 95% for distribution, underground, transmission, and sub-transmission assets. Additionally, a minimum confidence level of 98% must be realized for tested streetlights. The inspection process requires stray/elevated voltage testing be conducted for each utility asset that is capable of conducting electricity, along with having the ability of the general public to access said asset. In order for the QA/QC test to have "passed," it must confirm that all assets having a "testable object" were in fact tested.

Results-Stray Voltage ("EV") Testing

The 2011 QA Program involved 3,762 cumulative elevated voltage inspections across the eight operating regions within Upstate New York resulting in a 99.2% compliance rating related to National Grid's testing program.

Total Inspection Population

Upstate NY Regions	# of Inspections
Region # 48 - Frontier	364
Region # 50 - Genesee	262
Region # 51 - Southwest	249
Region # 54 - Central	368
Region # 56 - Mohawk Valley	742
Region # 57 - Northern	547
Region # 60 - Capital	727
Region # 62 - Northeast	503
Total	**3762**

Region and Asset Type Distribution

Structure Type	Region 48	Region 50	Region 51	Region 54	Region 56	Region 57	Region 60	Region 62	Totals
Distribution	250	205	205	271	691	482	632	422	3,158
Underground	26	6	6	53	15	23	20	38	187
Transmission	10	24	9	9	12	11	45	13	133
Sub Trans	16	20	20	10	7	11	6	7	97
Streetlights	62	7	9	25	17	20	24	23	187
Totals	**364**	**262**	**249**	**368**	**742**	**547**	**727**	**503**	**3,762**

Independent QA Audit

The completed Quality Assurance audit identified two issues related to the field inspection process:

1. PSC Reportable Testing Failures: (0.8% of the total assets audited)
2. QC Data Quality Improvements: (9.8% of the total assets audited)

PSC Reportable Testing Failures

A PSC Reportable Testing Failure occurs when both the EV Tester and the QC (Self Auditor) both have determined that there was no testable object, but the independent QA auditor determined that a testable object does exist (31 occurrences or 0.8% of assets independently audited). In this instance, the involved structures were subsequently re-tested and inspected through the independent QA audit process. The corresponding data analysis revealed that a limited number of field inspectors and self auditors had difficulty in identifying guy wires/anchors as testable objects (eleven occurrences) with additional reporting failures applicable to accurate identification of metal poles (ten occurrences).

Structure Type	Region 48 PSC Fail	Region 50 PSC Fail	Region 51 PSC Fail	Region 54 PSC Fail	Region 56 PSC Fail	Region 57 PSC Fail	Region 60 PSC Fail	Region 62 PSC Fail	Total
Distribution	3	0	1	3	4	2	0	0	13
Underground	0	0	0	0	0	0	0	0	0
Transmission	0	0	0	0	0	0	17	0	17
Sub Trans	1	0	0	0	0	0	0	0	1
Streetlights	0	0	0	0	0	0	0	0	0
Totals	**4**	**0**	**1**	**3**	**4**	**2**	**17**	**0**	**31**

QC Data Quality Failures

QC Data Quality failures occurred when the independent auditor's test result differed from the results identified by the testing organization. There are three types of QC Data Quality failures:

- The first data quality failure is considered to be an over testing and data recording issue. The EV tester and self QC auditor both determined there was a testable object, whereas the independent QA auditor's inspection revealed no testable component existed at the involved structure (352 total occurrences).

- The second data failure involved the self QC Auditor determining that a testable object did not exist. In this scenario, the independent QA auditor and the EV inspector determined there was in fact a testable component. The structure had actually been tested properly by the EV field tester, but reported incorrectly during the QC self audit process (8 total occurrences).

- The third and final data failure is related to the self QC auditor determining that a testable object did exist, when both the independent auditor and the EV field tester determined a testable component did not exist (8 total occurrences).

QC Data Quality Deficiencies

A total of 368 inspections (approximately 10% of 3,762 inspection population) resulted in a data quality problem being realized. The issue involved both the EV field inspector and the QC Auditor having determined that a testable object had been identified. In each of these instances the follow-up QA Field Assessment verified the non-existence of a testable object. An analysis of the data concluded that 304 or 82.6% of these Data Quality failures were related to incorrect identification of testable components on wooden poles.

QC Data Quality Deficiencies

Structure Type	Region 48 Data	Region 50 Data	Region 51 Data	Region 54 Data	Region 56 Data	Region 57 Data	Region 60 Data	Region 62 Data	Total
Distribution	5	1	1	4	14	34	197	98	354
Underground	1	0	0	0	1	0	0	4	6
Transmission	0	0	0	0	0	0	0	0	0
Sub Trans	0	1	0	0	0	0	4	0	5
Streetlights	0	0	0	2	0	0	0	1	3
Totals	**6**	**2**	**1**	**6**	**15**	**34**	**201**	**103**	**368**

Opportunities for Program Improvement

Based upon the Company's Quality Assurance Program findings, Operations Performance QA/QC should conduct an additional investigation and analysis into the reported deficiencies applicable to both the EV and IM field inspection process. Once the investigation process has been completed, the responsible process owner should develop and implement an action plan to effectively correct identified program deficiencies, and establish controls designed to diminish the potential for recurrence.

Asset Inspection (IM) Program

- **Maintenance Code Deficiencies:** The QA/QC analysis of the Additional Maintenance codes missed (defects) conducted by Premier LLC in 2011 concluded that the following three codes were missed repeatedly (44% of the entire defects sample size). Additional investigation into causal factors associated with missed/incorrect 220, 221 and 284 codes is required**.**

  Action item: Operations Performance QA/QC and Electric Operations to conduct further analysis of data file and additional investigation into identification of deficiency causal factors. Process Owner (TBD) is responsible for the drafting and implementation of any/all subsequent corrective action plan items.

Data Quality Deficiencies

- **Data Quality Deficiencies:** A total of 368 inspections (approximately 10% of 3,762 inspection population) resulted in a data quality problem being realized. The issue involved both the EV field inspector and the QC Auditor having determined that a testable object had been identified. In each of these instances the follow-up QA Field Assessment verified the non-existence of a testable object. An analysis of the data concluded that 304 or 82.6% of these Data Quality failures were related to incorrect identification of testable components on wooden poles.

- **Action Item:** National Grid QA/QC will conduct further analysis of field inspection, QC audit and QA Asset Inspection data for identification of potential trending, along with associated causal factors related to subsequent findings. In addition, QA/QC will field inspect a random sample of the 368 sites identified as having data quality deficiencies for the purpose of validating completed independent QA audit findings.

C. Independent Transmission Facility Inspection Audit

Independent Transmission Facility Inspection Audit findings are addressed in the Asset Management Summary of Audit Report attached as Appendix 17.

APPENDIX SUMMARY

Appendix 1: Stray Voltage Testing Summary

Appendix 2: Summary of Energized Objects

Appendix 3: Summary of Shock Reports from the Public

Appendix 4: Summary of Deficiencies and Repair Activity Resulting from the Inspection Process

Appendix 5: Temporary Repair Exceptions

Appendix 6: Inspections Summary

Appendix 7: Summary of Overdue Repairs

Appendix 8: Mobile Testing

Appendix 9: NG-EOP G016 Equipment Elevated Voltage Testing

Appendix 10: NG-EOP D004 Distribution Line Patrol and Maintenance

Appendix 11: NG-USA EOP UG006 Underground Inspection and Maintenance

Appendix 12: PR 06.01.601.001 Transmission Line Maintenance Procedure

Appendix 13: NG-EOP G017 Street Light Standard Inspection Program

Appendix 14: NG-EOP G004 Shock Complaints

Appendix 15: SMS 400.06.1 Substation V&O Inspection Standard and SMP 400.06.2 Substation Inspection Procedure

Appendix 16: NG-EOP G029 Tracking Temporary Repairs To Electric System

Appendix 17: Asset Management Summary of Audit

Appendix 18: Certifications

Appendix 1

Stray Voltage Testing Summary

Appendix 1

Stray Voltage Testing Summary

nationalgrid Data as of December 31, 2011	Total System Units Requiring Testing	Units Completed	Percent Completed	Units with Voltage Found (>= 1.0v)	Percent of Units Tested with Voltage (>= 1.0v)	Units Classified as Inaccessible
Distribution Facilities	1,245,018	1,245,018	100.00%	263	0.021%	8,747
Monthly Update		106,839	8.58%	19	0.018%	1,266
Underground Facilities	95,159	95,159	100.00%	5	0.005%	1,392
Monthly Update		4,565	4.80%		0.000%	108
Street Lights / Traffic Signals	87,839	87,839	100.00%	175	0.199%	786
Monthly Update		1,304	1.48%		0.000%	12
Substation Fences	908	908	100.00%			58
Monthly Update		413	45.48%			
Transmission	98,633	98,633	100.00%	116	0.12%	4,982
Monthly Update		3,474	3.52%	6	0.17%	205
TOTAL	1,527,557	1,527,557	100.00%	559	0.04%	15,965
Monthly Update		116,182	7.61%	25	0.02%	1,591

Appendix 2

Summary of Energized Objects

Appendix 2

Summary of Energized Objects (Manual Testing)

nationalgrid

Data as of December 31, 2011

	Initial Readings				Readings After Mitigation		
	1 - 4.4 V	4.5 - 24.9 V	> 25 V	Total	< 1 V	1 - 4.4 V	> 4.5 V
Distribution Facilities	231	22	10	263	218	18	0
Pole (910)	10	3	1	14	9	5	0
Ground (914)	93	6	4	103	87	8	0
Guy (915)	118	7	1	126	103	9	0
Riser (916)	28	3	2	33	27	0	0
Other	14	5	3	22	21	1	0
Underground Facilities	5	0	0	5	5	0	0
Handhole / Pull box (950)	1	0	0	1	1	0	0
Manhole (951)	0	0	0	0	0	0	0
Padmount Switchgear (952)	1	0	0	1	1	0	0
Padmount Transformer (953)	3	0	0	3	3	0	0
Vault – Cover/Door (954)	0	0	0	0	0	0	0
Pedestal	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Street Lights / Traffic Signals	87	80	8	175	164	0	0
Metal Street Light Pole (971/981)	81	79	8	168	159	0	0
Traffic Signal Pole (991)	2	0	0	2	0	0	0
Control Box (992)	1	0	0	1	1	0	0
Pedestrian Crossing Pole (993)	0	0	0	0	0	0	0
Other	3	1	0	4	4	0	0
Substation Fences	0	0	0	0	0	0	0
Fence (995)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Transmission	107	8	1	116	72	19	1
Lattice Tower (931)	6	4	1	11	8	2	0
Pole (930)	4	1	0	5	3	1	0
Ground (933)	75	7	1	83	47	15	1
Guy (934)	0	0	0	0	0	0	0
Other	30	0	0	30	24	1	0
Totals	430	110	19	559	459	37	1

Appendix 3

Summary of Shock Reports from the Public

Appendix 3

Summary of Shock Reports from the Public

nationalgrid 2011 1st Qurater January 1, 2011 - March 31, 2011	Quarterly Update	Yearly Total
I. Total shock calls received:	**28**	**28**
Unsubstantiated	4	4
Normally Energized Equipment	2	2
Stray Voltage:		
Person	22	22
Animal		
II. Injuries Sustained/Medical Attention Received Due To SV		
Person	1	1
Animal		
III. Voltage Source:	**22**	**22**
Utility Responsibility		
Issue with primary, joint, or transformer	1	1
Secondary joint (Crab)		
SL service Line		
Abandoned SL service line		
Defective service line		
Abandoned service line		
OH Secondary		
OH Service		
OH Service neutral	1	1
Pole		
Riser		
Other	1	1
Customer Responsibility		
Contractor damage		
Customer equipment/wiring	19	19
Other Utility/Gov't Agency Responsibility		
SL Base Connection		
SL Internal wiring or light fixture		
Overhead equipment		
IV. Voltage Range:	**22**	**22**
1.0V to 4.4V	2	2
4.5V to 24.9V	2	2
25V and above	6	6
Unknown	12	12

nationalgrid 2011 2nd Quarter April 1, 2011 - June 30, 2011	Quarterly Update	Yearly Total
I. Total shock calls received:	**56**	**84**
Unsubstantiated	6	10
Normally Energized Equipment	13	15
Stray Voltage:		
Person	36	58
Animal	1	1
II. Injuries Sustained/Medical Attention Received Due To SV		
Person		0
Animal		
III. Voltage Source:	**37**	**59**
Utility Responsibility		
Issue with primary, joint, or transformer	4	5
Secondary joint (Crab)		
SL service Line		
Abandoned SL service line		
Defective service line		
Abandoned service line		
OH Secondary		
OH Service	7	7
OH Service neutral	5	6
Pole		
Riser		
Other		1
Customer Responsibility		
Contractor damage		
Customer equipment/wiring	21	40
Other Utility/Gov't Agency Responsibility		
SL Base Connection		
SL Internal wiring or light fixture		
Overhead equipment		
IV. Voltage Range:	**37**	**59**
1.0V to 4.4V	2	4
4.5V to 24.9V	6	8
25V and above	7	13
Unknown	22	34

nationalgrid 2011 3rd Quarter July 1, 2011 - September 30, 2011	Quarterly Update	Yearly Total
I. Total shock calls received:	**67**	**151**
Unsubstantiated	8	18
Normally Energized Equipment	17	32
Stray Voltage:		
Person	42	100
Animal		1
II. Injuries Sustained/Medical Attention Received Due To SV		
Person	6	7
Animal		
III. Voltage Source:	**42**	**101**
Utility Responsibility		
Issue with primary, joint, or transformer	7	12
Secondary joint (Crab)		
SL service Line		
Abandoned SL service line		
Defective service line		
Abandoned service line		
OH Secondary		
OH Service	1	8
OH Service neutral	5	11
Pole	2	2
Riser		
Other		1
Customer Responsibility		
Contractor damage		
Customer equipment/wiring	27	67
Other Utility/Gov't Agency Responsibility		
SL Base Connection		
SL Internal wiring or light fixture		
Overhead equipment		
IV. Voltage Range:	**42**	**101**
1.0V to 4.4V	5	9
4.5V to 24.9V	2	10
25V and above	10	23
Unknown	25	59

nationalgrid 2011 4th Quarter October 1, 2011 - December 31, 2011	Quarterly Update	Yearly Total
I. Total shock calls received:	**34**	**185**
Unsubstantiated	1	19
Normally Energized Equipment	14	46
Stray Voltage:		
Person	16	116
Animal **(*Shock in Nov included owner & dog)**	3	**4**
II. Injuries Sustained/Medical Attention Received Due To SV		
Person	4	11
Animal		
III. Voltage Source:	**18**	**119**
Utility Responsibility		
Issue with primary, joint, or transformer	1	13
Secondary joint (Crab)		
SL service Line	1	1
Abandoned SL service line		
Defective service line		
Abandoned service line		
OH Secondary		
OH Service	1	9
OH Service neutral	2	13
Pole		2
Riser		
Other	2	3
Customer Responsibility		
Contractor damage		
Customer equipment/wiring	11	78
Other Utility/Gov't Agency Responsibility		
SL Base Connection		
SL Internal wiring or light fixture		
Overhead equipment		
IV. Voltage Range:	**18**	**119**
1.0V to 4.4V	1	10
4.5V to 24.9V	4	14
25V and above	3	26
Unknown	10	69

Appendix 4

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process

Appendix 4

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Distribution								
Overhead Facilities	**2010**				**2011**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Poles								
Pole Condition								
Number of Deficiencies	26	2281	7495	33	20	3740	2893	54
Repaired in Time Frame	25	1894	1309	30	19	280	81	46
Repaired - Overdue	1	343	0	3	1	0	0	3
Not Repaired - Not Due	0	0	6186	0	0	3460	2812	5
Not Repaired - Overdue	0	44	0	0				
Grounding System								
Number of Deficiencies	50	3617	8253	0	61	3545	966	1
Repaired in Time Frame	50	3562	2390	0	61	468	88	1
Repaired - Overdue	0	55	0	0				
Not Repaired - Not Due	0	0	5863	0	0	3077	878	0
Not Repaired - Overdue								
Anchors/Guy Wire								
Number of Deficiencies	3	2093	5104	13	2	940	6901	16
Repaired in Time Frame	3	1983	611	12	2	86	177	16
Repaired - Overdue	0	77	0	1				
Not Repaired - Not Due	0	0	4493	0	0	854	6724	0
Not Repaired - Overdue	0	33	0	0				
Cross Arm/Bracing								
Number of Deficiencies	41	735	2994	0	30	940	81	5
Repaired in Time Frame	41	703	440	0	30	124	1	5
Repaired - Overdue	0	32	0	0				
Not Repaired - Not Due	0	0	2554	0	0	816	80	0
Not Repaired - Overdue								
Riser								
Number of Deficiencies	2	1235	538	0	11	1857	769	2

Repaired in Time Frame	2	1207	128	0	11	249	24	2
Repaired - Overdue	0	26	0	0				
Not Repaired - Not Due	0	0	410	0	0	1608	745	0
Not Repaired - Overdue	0	2	0					
Conductors								
Primary Wire/Broken Ties								
Number of Deficiencies	104	203	87	2	90	211	40	4
Repaired in Time Frame	104	202	9	2	89	33	3	4
Repaired - Overdue	0	1	0	0	1	0	0	0
Not Repaired - Not Due	0	0	78	0	0	178	37	0
Not Repaired - Overdue								
Secondary Wire								
Number of Deficiencies	24	134	592	7	60	318	789	3
Repaired in Time Frame	24	132	92	7	58	30	29	3
Repaired - Overdue	0	2	0	0	2	0	0	0
Not Repaired - Not Due	0	0	500	0	0	288	760	0
Not Repaired - Overdue								
Neutral								
Number of Deficiencies								
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Insulators								
Number of Deficiencies	18	219	295	2	14	357	225	4
Repaired in Time Frame	17	211	35	1	14	52	31	4
Repaired - Overdue	1	8	0	1				
Not Repaired - Not Due	0	0	260	0	0	305	194	0
Not Repaired - Overdue								
Pole Equipment								
Transformers								
Number of Deficiencies	3	7546	1363	1	2	5862	1706	
Repaired in Time Frame	3	6859	867	1	2	814	108	
Repaired - Overdue	0	563	0	0				
Not Repaired - Not Due	0	0	496	0	0	5048	1598	
Not Repaired - Overdue	0	124	0	0				
Cutouts								
Number of Deficiencies	45	70	7260	2	46	5233	0	

Repaired in Time Frame	45	69	802	2	45	412	0	
Repaired - Overdue	0	1	0	0	1	0	0	
Not Repaired - Not Due	0	0	6458	0	0	4821	0	
Not Repaired - Overdue								
Lightning Arrestors								
Number of Deficiencies	0	4	1267		0	99	577	
Repaired in Time Frame	0	4	187		0	4	13	
Repaired - Overdue								
Not Repaired - Not Due	0	0	1080		0	95	564	
Not Repaired - Overdue								
Other Equipment								
Number of Deficiencies	1	1061	1298		3	1807	1455	1
Repaired in Time Frame	1	1049	196		3	218	30	1
Repaired - Overdue	0	11	0					
Not Repaired - Not Due	0	0	1102		0	1589	1425	0
Not Repaired - Overdue	0	1	0					
Miscellaneous								
Trimming Related								
Number of Deficiencies	20	0	2006		32	0	1669	
Repaired in Time Frame	20	0	347		32	0	3	
Repaired - Overdue								
Not Repaired - Not Due	0	0	1659		0	0	1666	
Not Repaired - Overdue								
Temporary Repairs								
Number of Temp Repairs	0	0	0	13				
Repaired in Time Frame	0	0	0	8				
Repaired - Overdue	0	0	0	5				
Not Repaired - Not Due								
Not Repaired - Overdue								
Other								
Number of Deficiencies	0	1	0					
Repaired in Time Frame	0	1	0					
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Overhead Facilities Total								
Total								
Number of Deficiencies	337	19199	38552	73	371	24909	18071	90

Repaired in Time Frame	335	17876	7413	63	366	2770	588	82
Repaired - Overdue	2	1119	0	0	5	0	0	3
Not Repaired - Not Due	0	0	31139	0	0	22139	17483	5
Not Repaired - Overdue	0	204	0	0				

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Transmission								
Transmission Facilities	**2010**				**2011**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Towers/Poles								
Steel Towers								
Number of Deficiencies	0	12	45		0	8	119	
Repaired in Time Frame	0	12	17		0	1	2	
Repaired - Overdue								
Not Repaired - Not Due	0	0	28		0	7	117	
Not Repaired - Overdue								
Poles								
Number of Deficiencies	0	35	637		1	201	1286	9
Repaired in Time Frame	0	31	23		0	17	12	1
Repaired - Overdue	0	2	0		1	0	0	3
Not Repaired - Not Due	0	0	614		0	184	1274	0
Not Repaired - Overdue	0	2	0		0	0	0	5
Anchors/Guy Wire								
Number of Deficiencies	0	9	123		0	9	170	
Repaired in Time Frame	0	9	18		0	1	16	
Repaired - Overdue								
Not Repaired - Not Due	0	0	105		0	8	154	
Not Repaired - Overdue								
Crossarm/Brace								
Number of Deficiencies	0	13	84		2	24	140	2
Repaired in Time Frame	0	12	10		2	3	2	1
Repaired - Overdue								
Not Repaired - Not Due	0	0	74		0	21	138	1
Not Repaired - Overdue	0	1	0					
Grounding System								
Number of Deficiencies	0	25	192		0	12	243	

Repaired in Time Frame	0	2	44		0	3	0	
Repaired - Overdue	0	23	0					
Not Repaired - Not Due	0	0	148		0	9	243	
Not Repaired - Overdue								
Conductors								
Cable								
Number of Deficiencies	0	2	6		6	6	37	1
Repaired in Time Frame	0	2	1		6	1	0	1
Repaired - Overdue								
Not Repaired - Not Due	0	0	5		0	5	37	0
Not Repaired - Overdue								
Static/Neutral								
Number of Deficiencies	0	4	21		0	5	57	
Repaired in Time Frame	0	4	9		0	2	1	
Repaired - Overdue								
Not Repaired - Not Due	0	0	12		0	3	56	
Not Repaired - Overdue								
Insulators								
Number of Deficiencies	1	42	193		4	35	498	
Repaired in Time Frame	1	40	32		4	18	23	
Repaired - Overdue	0	2	0					
Not Repaired - Not Due	0	0	161		0	17	475	
Not Repaired - Overdue								
Miscellaneous								
Right of Way Condition								
Number of Deficiencies	0	0	6		0	0	8	
Repaired in Time Frame	0	0	6					
Repaired - Overdue								
Not Repaired - Not Due					0	0	8	
Not Repaired - Overdue								
Temporary Repairs								
Number of Temp Repairs				6				
Repaired in Time Frame				2				
Repaired - Overdue				4				
Not Repaired - Not Due								
Not Repaired - Overdue								
Other								
Number of Deficiencies	9	37	38		12	39	16	

Repaired in Time Frame	9	33	8		12	9	0	
Repaired - Overdue	0	3	0					
Not Repaired - Not Due	0	0	30		0	30	16	
Not Repaired - Overdue	0	1	0					
Transmission Facilities Total								
Total								
Number of Deficiencies	10	179	1345	6	25	339	2574	12
Repaired in Time Frame	10	145	168	2	24	55	56	3
Repaired - Overdue	0	30	0	4	1	0	0	3
Not Repaired - Not Due	0	0	1177	0	0	284	2518	1
Not Repaired - Overdue	0	4	0	0	0	0	0	5

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Underground								
Underground Facilities	**2010**				**2011**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Underground Structures								
Damaged Cover								
Number of Deficiencies	0	12	85		1	3	43	1
Repaired in Time Frame	0	12	52		1	0	1	1
Repaired - Overdue								
Not Repaired - Not Due	0	0	33		0	3	42	0
Not Repaired - Overdue								
Damaged Structure								
Number of Deficiencies	30	569	14		67	597	4	4
Repaired in Time Frame	30	568	1		67	136	0	3
Repaired - Overdue								
Not Repaired - Not Due	0	0	13		0	461	4	0
Not Repaired - Overdue	0	1	0		0	0	0	1
Congested Structure								
Number of Deficiencies								
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Damaged Equipment								

Number of Deficiencies	1	15	0		1	9	0	0
Repaired in Time Frame	1	15	0		1	0	0	0
Repaired - Overdue								
Not Repaired - Not Due					0	9	0	0
Not Repaired - Overdue								
Conductors								
Primary Cable								
Number of Deficiencies	0	49	0		0	13	0	0
Repaired in Time Frame	0	43	0					
Repaired - Overdue	0	6	0					
Not Repaired - Not Due					0	13	0	0
Not Repaired - Overdue								
Secondary Cable								
Number of Deficiencies	3	0	0		1	-	-	-
Repaired in Time Frame	3	0	0		1	-	-	-
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Neutral Cable								
Number of Deficiencies								
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Racking Needed								
Number of Deficiencies	0	303	0		0	207	0	1
Repaired in Time Frame	0	278	0		0	5	0	0
Repaired - Overdue	0	19	0					
Not Repaired - Not Due					0	202	0	1
Not Repaired - Overdue	0	6	0					
Miscellaneous								
Temporary Repairs								
Number of Temp Repairs								
Repaired in Time Frame								
Repaired – Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								

Other								
Number of Deficiencies	0	835	138		0	927	320	0
Repaired in Time Frame	0	753	38		0	4	2	0
Repaired - Overdue	0	65	0					
Not Repaired - Not Due	0	0	100		0	923	318	0
Not Repaired - Overdue	0	17	0					
Underground Facilities Total								
Total								
Number of Deficiencies	34	1783	237		70	1756	367	6
Repaired in Time Frame	34	1669	91		70	145	3	4
Repaired - Overdue	0	90	0					
Not Repaired - Not Due	0	0	146		0	1611	364	1
Not Repaired - Overdue	0	24	0		0	0	0	1

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Pad Mount Transformers								
Pad Mount Transformers	**2010**				**2011**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Pad Mount Transformers								
Damaged Structure								
Number of Deficiencies	11	119	43		10	118	43	
Repaired in Time Frame	11	119	3		10	9	0	
Repaired - Overdue								
Not Repaired - Not Due	0	0	40		0	109	43	
Not Repaired - Overdue								
Damaged Equipment								
Number of Deficiencies					-	-	1	
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due					-	-	1	
Not Repaired - Overdue								
Cable Condition								
Number of Deficiencies								
Repaired in Time Frame								

Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Oil Leak								
Number of Deficiencies	2	41	0		3	74	0	
Repaired in Time Frame	2	41	0		3	0	0	
Repaired - Overdue								
Not Repaired - Not Due					0	74	0	
Not Repaired - Overdue								
Off Pad								
Number of Deficiencies	23	105	0		10	149	0	1
Repaired in Time Frame	23	102	0		10	28	0	1
Repaired - Overdue	0	3	0					
Not Repaired - Not Due					0	121	0	0
Not Repaired - Overdue								
Lock/Latch/Penta								
Number of Deficiencies								
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Miscellaneous								
Temporary Repairs								
Number of Temp Repairs				1				
Repaired in Time Frame				1				
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Other								
Number of Deficiencies	0	3	881		0	1	1002	
Repaired in Time Frame	0	3	8					
Repaired - Overdue								
Not Repaired - Not Due	0	0	873		0	1	1002	
Not Repaired - Overdue								
Pad Mount Total								
Total								
Number of Deficiencies	36	268	924	1	23	342	1046	1
Repaired in Time Frame	36	265	11	1	23	37	0	1

Repaired - Overdue	0	3	0	0				
Not Repaired - Not Due	0	0	913	0	0	305	1046	0
Not Repaired - Overdue								

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Streetlights								
Overhead Facilities	**2010**				**2011**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Streetlight								
Base/Standard/Light								
Number of Deficiencies					-	681	7	
Repaired in Time Frame					-	5	-	
Repaired - Overdue								
Not Repaired - Not Due					-	676	7	
Not Repaired - Overdue								
Handhole/Service Box								
Number of Deficiencies								
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Service/Internal Wiring								
Number of Deficiencies	2,309				1	19	3	
Repaired in Time Frame	2,309				1	4	-	
Repaired - Overdue								
Not Repaired - Not Due					-	15	3	
Not Repaired - Overdue								
Access Cover								
Number of Deficiencies	0	6	0		-	1	2	
Repaired in Time Frame	0	6	0					
Repaired - Overdue								

Not Repaired - Not Due					-	1	2	
Not Repaired - Overdue								
Miscellaneous								
Temporary Repairs								
Number of Temp Repairs								
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due								
Not Repaired - Overdue								
Other								
Number of Deficiencies					-	18	1	
Repaired in Time Frame								
Repaired - Overdue								
Not Repaired - Not Due					-	18	1	
Not Repaired - Overdue								
Streetlight Total								
Total								
Number of Deficiencies	2309	6	0		1	719	13	
Repaired in Time Frame	2309	6	0		1	9	-	
Repaired - Overdue								
Not Repaired - Not Due					-	710	13	
Not Repaired - Overdue								

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Level IV Conditions				
Overhead Facilities	**2010**		**2011**	
	Number of Conditions Found	**Number of Conditions Repaired**	**Number of Conditions Found**	**Number of Conditions Repaired**
Overhead Facilities				
Pole Condition				
Pole Condition	28443	20147	26504	16856
Grounding System	71189	2	12666	0
Anchors/Guy Wire	44865	18413	48643	13223
Cross Arm/Bracing	16354	2	2103	1
Riser				
Conductors				
Primary Wire/Broken Ties	1198	0	1044	0
Secondary Wire	445	0		
Neutral				
Insulators	18864	3	9083	1
Pole Equipment				
Transformers	28904	239	24961	3
Cutouts	23814	0	28359	1
Lightning Arrestors	1685	0	2818	0
Other Equipment	11964	0	370	0
Miscellaneous				
Trimming Related				
Other	27	1	46	0
Overhead Facilities Total	247752	38807	156597	30085
Transmission Facilities				
Towers/Poles				
Steel Towers	161	0	142	0
Poles	854	4	3492	11
Anchors/Guy Wire	595	224	224	213
Crossarm/Brace	1	0		
Grounding System	47	7	43	0
Conductors				
Cable	14	0	9	0
Static/Neutral				

Insulators	205	1	138	0
Miscellaneous				
Right of Way Condition	376	1	369	0
Other	5722	2105	7925	2962
Transmission Facilities Total	7975	2342	12342	3186
Underground Facilities				
Underground Structures				
Damaged Cover	73	2	10	0
Damaged Structure	352	128	225	63
Congested Structure				
Damaged Equipment	189	6	124	4
Conductors				
Primary Cable	4	4	2	2
Secondary Cable	5	5	11	11
Neutral Cable				
Racking Needed	25	25	23	23
Miscellaneous				
Other	5965	2397	5552	1928
Underground Facilities Total	6613	2567	5947	2031
Pad Mount Transformers				
Underground Structures				
Damaged Structure	2236	1825	3036	2197
Damaged Equipment				
Damaged Cable				
Oil Leak				
Off Pad				
Lock/Latch/Penta				
Miscellaneous				
Other	4348	4203	4822	4822
Pad Mount Transformer Total	6584	6028	7858	7019
Streetlights				
Streetlight				
Base/Standard/Light			6995	0
Handhole/Service Box				
Service/Internal Wiring			4696	0
Access Cover			11142	1

Miscellaneous				
Other			260	0
Streetlight Total			23,093	1
Total Level IV Conditions				
Overall Total	268,924	49,744	205,837	42,322

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process							
Year	**Priority Level / Repair Expected**		**Deficiencies Found (Total)**	**Repaired In Time Frame**	**Repaired - Overdue**	**Not Repaired - Not Due**	**Not Repaired - Overdue**
2010							
	I	Within 1 week	2726	2724	2		
	II	Within 1 year	21435	19961	1242		232
	III	Within 3 years	41058	7683		33375	
	IV	N/A	268924	49744	0	219179	0
	Temp Repairs	Within 90 days	80	66	14	0	0
2011							
	I	Within 1 week	490	484	6		
	II	Within 1 year	28065	3016	0	25049	
	III	Within 3 years	22071	647	0	21424	
	IV	N/A	205838	42322	0	163516	0
	Temp Repairs	Within 90 days	109	90	6	7	6

Appendix 5

Temporary Repair Exceptions

Appendix 5

Temporary Repair Exceptions

National Grid has 7 temporary repair exceptions to report.

Distribution

Feeder#	Line#	Pole#	Location	Region	Op District	Date Inspected	Comments	Maint Code	Priority	Comments	Work Order#	Quantity
28452	59	12	ROCK COVE RD OFF RT.9N TAP P 35	62	40	10/03/2011 0:00	THIS JOB WILL BE DELAYED DUE TO INACCESSIBILITY AND COORDINATION WITH TELEPHONE AND CABLE. IT WILL BE SCHEDULED IN LATE SPRING 2012	110	9	repaired crossarm	11784795	1

Transmission

Circuit ID#	Structure#	Region	District	Location	Structure Type	Date Inspected	Maint Code	Priority	Quantity	Comments	Circuit Name	Work Order#
T1440	208	48	01	row-btwn/lockport rd+mapleton rd	FL	10/17/2011 0:00	539	2	1	REPLACE ARMS	36 Huntley to Lockport (T1440)	12033124
T1440	208	48	01	row-btwn/lockport rd+mapleton rd	FL	10/17/2011 0:00	539	9	1	TEMP ARM REPAIR	36 Huntley to Lockport (T1440)	
A0797	442	57	24	rte 3	SI	07/19/2011 0:00	510	9		METAL STAKES LASHED	38 Gilpin Bay to Tupper Lake (A0797)	
A0799	283	57	24	rte 30	SI	07/21/2011 0:00	511	9		METAL STAKES LASHED	38 Lake Clear to Gilpin Bay (A0799)	
A0799	292	57	24	rte 30	SI	07/21/2011 0:00	511	9		METAL STAKES LASHED	38 Lake Clear to Gilpin Bay (A0799)	
A0799	298	57	24	hwy 30	SI	07/19/2011 0:00	510	9		METAL STAKES LASHED	38 Lake Clear to Gilpin Bay (A0799)	
A0620	3.	57	28	lee dr	SI	09/19/2011 13:08	510	9		metal splice	23 Eel Weir to Heuvelton (A0620)	

Appendix 6

Inspections Summary

Appendix 6

2011 PSC QTR 4 REPORT

NATIONAL GRID 2010- 2014 Inspection Summary	Total System Units	2010 Units Completed	2011 Units Completed	2012 Units Completed	2013 Units Completed	2014 Units Completed	2010 - 2014 Units Completed	2010 - 2014 Percent Completed
Distribution - Unique Inspections	1,217,184	232,604	246,005	0	0	0	478,609	39.32%
Distribution - Total Inspections		233,011	246,657	0	0	0	479,668	n/a
Underground Facilities - Unique	93,624	17,624	19,987	0	0	0	37,611	40.17%
Underground Facilities - Total		19,143	20,306	0	0	0	39,449	n/a
URD - Unique Inspections	64,066	10,619	12,846	0	0	0	23,465	36.63%
URD -Total Inspections		10,628	12,858	0	0	0	23,486	n/a
Street Light / Traffic Sig - Unique	65,838	5,200	35,733	0	0	0	40,933	62.17%
Street Light / Traffic Sig - Total		5,200	36,159	0	0	0	41,359	n/a
Transmission - Unique Inspections	100,906	20,369	27,148	0	0	0	47,517	47.09%
Transmission - Total Inspections		20,924	27,454	0	0	0	48,378	n/a
Grand Total - Unique Inspections	1,541,618	286,416	341,719	0	0	0	628,135	40.75%

Appendix 7

Summary of Overdue Repairs

Appendix 7

Summary of Overdue Repairs for Level II Repairs

Year	Facilities	-- Repaired -- Number of Days Overdue				-- Not Repaired -- Number of Days Overdue				Comments
		1-30	31-90	91-180	>180	1-30	31-90	91-180	>180	
2009	Distribution									
	Transmission									
	Subtransmission									
	Underground									
	Pad-mounts									
	Streetlights									
2010	Distribution	126	9							REPAIRED: Done, Completed 10/9 and 11/8th, respectively.
	Transmission		2					1		REPAIRED: Done, Completed 10/25 & 10/26 NOT REPAIRED:
	Subtransmission				1				3	REPAIRED: Work is going to be done on WR 11073391 We are still having problems getting access through the wetlands and obtaining a permit NOT REPAIRED: Maint items 551 & 541 on Pole 56 COMPLETED - Remaining maint items/work under review for line retirement. I do not have a completion date.
	Underground		11			1		23		REPAIRED: Done, awaiting as builts from supervisors NOT REPAIRED: 70% completed, waiting on Optec (environmental remediation in manhole) so we can finish the work.
	Pad-mounts									
	Streetlights									
2011	Distribution									
	Transmission	1				1				REPAIRED: Done, Completed 12/13/11. NOT REPAIRED: Inspection date was in January of 2011; work order wasn?t created until July, tracking of an incorrect due date. Unfortunately the Leeds-Pleasant Valley is a 345 kv line and outages are difficult to obtain on short notice; earliest completion date on the line is 3/3/2012.
	Subtransmission									
	Underground					29				NOT REPAIRED: Due to the scheduling with Optec for the removal of oil & asbestos.
	Pad-mounts									
	Streetlights									

Summary of Overdue Repairs for Level III Repairs

Year	Facilities	-- Repaired -- Number of Days Overdue				-- Not Repaired -- Number of Days Overdue				Comments
		1-30	31-90	91-180	>180	1-30	31-90	91-180	>180	
2009	Distribution									
	Transmission									
	Underground									
	Pad-mounts									
	Streetlights									
2010	Distribution									
	Transmission									
	Underground									
	Pad-mounts									
	Streetlights									
2011	Distribution									
	Transmission									
	Underground									
	Pad-mounts									
	Streetlights									
2012	Distribution									
	Transmission									
	Underground									
	Pad-mounts									
	Streetlights									
2013	Distribution									
	Transmission									
	Underground									
	Pad-mounts									
	Streetlights									

Appendix 8

Mobile Testing

NEW YORK STATE DEPARTMENT OF PUBLIC SERVICE

METHOD OF SERVICE FORM

This form should be filed with all new petitions and applications that require action by the Commission. It will allow us to serve you with the Commission decision using the method you select.

Name:	Patric O'Brien
Your Company/Organization:	Niagara Mohawk Power Corporation d/b/a National Grid
Mailing Address:	40 Sylvan Road Waltham, MA 02451
Company/Organization you represent, if different from above:	_____
E-Mail Address:	patric.r.obrien@us.ngrid.com

If you consent to receive Commission-issued orders electronically, you will receive all Commission-issued documents electronically. If you do not consent to receive Commission-issued orders electronically, you will receive all Commission-issued documents by mail.

Check the box(es) in A or B, below:

A.

☒ I am authorized by the party I represent to grant consent to receive electronic-only service of Commission-issued orders, AND

☒ I, on behalf of myself or the party I represent, knowingly waive the right specified in Public Service Law §23(1) to be served personally or by mail with orders that affect me or the party I represent and consent to receive service of Commission-issued orders by electronic means only. This consent remains in effect until revoked.

B

☐ I do not consent to receive electronic service and instead request that the DPS mail Commission-issued document(s) to me.

Signature: Patric O'Brien	Date: 12/22/11

Patric R. O'Brien
Senior Counsel

December 22, 2011

VIA ELECTRONIC FILING

Honorable Jaclyn A. Brilling
Secretary
New York State Public Service Commission
Three Empire State Plaza
Albany, New York 12223-1350

Re: Case 10-E-0271 – In the Matter of Examining the Mobile Testing Requirements of the Electric Safety Standards

Dear Secretary Brilling:

Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid") submits for filing its 2011 Mobile Stay Voltage Testing Report pursuant to the Commission's *Order Requiring Additional Mobile Stray Voltage Testing* in the above proceeding. The report details the results of National Grid's mobile testing in the cities of Buffalo, Niagara Falls, and Albany during 2011.

Should you have any questions or concerns, please do not hesitate to contact me. Thank you for your time and attention.

Respectfully submitted,

/s/Patric R. O'Brien
Patric R. O'Brien

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T: 781.907.1850 ■ F: 781.907.5701 ■ patric.r.obrien@us.ngrid.com ■ www.nationalgrid.com

nationalgrid

2011 Mobile Stray Voltage Testing Report
December 22, 2011

A Background

Niagara Mohawk Power Corporation d/b/a National Grid ("Niagara Mohawk" or "Company") submits its 2011 Mobile Stray Voltage Testing Report ("Report") pursuant to the Public Service Commission's *Order Requiring Additional Mobile Stray Voltage Testing* ("Order"), issued July 21, 2010 in Case 10-E-0271. In compliance with the Commission's Order, Niagara Mohawk's 2011 mobile testing consisted of one mobile scan in Albany and Niagara Falls and two mobile scans in Buffalo. The results of the mobile scans are detailed in the tables below.

Niagara Mohawk utilized Power Survey LLC ("Power Survey"), which is currently the sole source vendor for mobile testing in New York State, to conduct the mobile scans. Niagara Mohawk also utilized Power Survey to perform the mobile scans for the Company in 2009 and 2010.

B. Mobile Testing Verification Process

Niagara Mohawk verifies a stray voltage finding made by the mobile scan by using its own internal testing verification procedure as outlined in Section V of the Company's Electric Operating Procedure NG-USA EOP G016. This entails using an HD probe to test all metallic objects in the area using a ground reference point of within five feet of the structure. In the event this method cannot verify the finding, the Company employs Power Survey's verification procedure, which allows for using a ground reference point of within 100 feet of the structure.

C. Mobile Testing Results by City

1. Albany

Testing began in Albany on October 11, 2011 and was completed on October 20, 2011 with the following results:

a. Total stray voltage findings = 148
b. Stray voltage findings at 4.4v and below = 104 (70%)
c. Stray voltage findings at 4.5v and above = 44 (30%)
d. Miles scanned = 227
e. Niagara Mohawk structures scanned = 4,776

Events/Hits			
	2009	2010	2011
Albany	**101**	**217**	**148**
89% of events in 2011 were found on streetlights			

2. Niagara Falls

Testing began in Niagara Falls on August 15, 2011 and was completed on August 16, 2011 with the following results:

a. Total stray voltage findings = 47
b. Stray voltage findings at 4.4v and below = 43 (91%)
c. Stray voltage findings at 4.5v and above = 4 (9%)
d. Miles scanned = 36
e. Niagara Mohawk structures scanned = 1,358

Events/Hits			
	2009	2010	2011
Niagara Falls	**54**	**11**	**47**
98% of events in 2011 were found on streetlights			

3. Buffalo

Niagara Mohawk conducted two separate mobile scans of Buffalo in 2011. The first began on June 6, 2011 and was completed on July 15, 2011 with the following results:

a. Total stray voltage findings = 714
b. Stray voltage findings at 4.4v and below = 573 (80%)
c. Stray voltage findings at 4.5v and above = 141 (20%)
d. Miles scanned = 1,441
e. Niagara Mohawk structures scanned[1] = 27,999

The second mobile scan began on August 17, 2011 and was completed on October 20, 2011 with the following results:

a. Total stray voltage findings = 566
b. Stray voltage findings at 4.4v and below = 475 (84%)
c. Stray voltage findings at 4.5v and above = 91 (16%)
d. Miles scanned[2] = 1,315
e. Niagara Mohawk structures scanned = 28,050

[1] Variances in scanned structures are attributable to unscannable assets due to inaccessible roadways due to construction, road blocks, and private roads.
[2] Variances in mileages are directly attributable to the same crews performing both scans and optimizing their routes during the second scan resulting in less overlap.

Events/Hits					
	2009	2010-Scan 1	2010-Scan 2	2011-Scan 1	2011-Scan 2
Buffalo	**2,678**	**931**	**837**	**714**	**566**
Approx 93% of events were found on streetlights (2011 Scans 1 & 2)					

A majority of the 2011 findings were below 4.5v in Albany (70%), Niagara Falls (91%), and Buffalo (78% in Scan 1 and 84% in Scan 2). The Buffalo scans have consistently resulted in a decrease in findings year after year. Indeed, Buffalo saw a 79 percent decrease from 2009 to 2011 Scan 2.

D. Mobile Testing Repair/Mitigation Efforts

As of December 9, 2011, Niagara Mohawk has completed 99.92% of the total repairs in Buffalo (Scan 1 & Scan 2), 95.74% in Niagara Falls, and 100% in Albany. The remaining repairs are broken conduit and cable repairs (grounded sections). The facilities have been made safe and temporary overhead repairs ("TOH") are in place as temporary fixes to keep the lights on.

A summary table illustrating repair status by region can be found in Appendices A-E. These tables are updated as of November 28, 2011, in contrast to the analysis above. Updated Appendices will be made available upon request.

E. Mobile Testing Program Costs

As of December 14, 2011, the mobile scan surveys totaled $2,041,776 and the repair costs have amounted to $2,421,625. The 2011 repair costs are lower when compared to previous years due to the reduced usage of TOH repairs (2009-499 TOH repairs, 2010-284 TOH repairs, 2011-48 TOH repairs). Please note that this is not the final cost amount. The Company is still making permanent repairs and not all cost information has been finalized.

City	Actual Miles	Events Found	Event Rate	Repairs	Mobile Inspection Cost	Repairs
Buffalo Scan 1	1,441	714	0.50	713	$1,956,240	$2,364,048
Buffalo Scan 2	1,315	566	0.43	559		
Niagara Falls	36	47	1.31	45	$38,880	$3,110
Albany	227	148	0.65	130	$46,656	$54,467
Total	3,019	1,475		1,447	$2,041,776	$2,421,625

F. Mobile and Manual Testing Program Comparison

It costs the Company on average 11 times more to conduct mobile testing (per mile cost) when compared to manual testing (per unit cost) in Albany, Niagara Falls, and Buffalo in 2011.

	Albany		Niagara Falls		Buffalo Scan 1 & 2	
2011 Estimated Costs	**Manual**[3]	**Mobile**	**Manual**	**Mobile**	**Manual**	**Mobile**
Non-Streetlighting Eqp.	$7,963	$46,656	$1,939	$38,880	$91,789	$1,956,240
Metallic Streetlighting Eqp.	$3,281		$1,406		$40,918	
Delta	Δ $35,412		Δ $35,535		Δ $1,823,533	

G. Buffalo University Stray Voltage Study

As stated in the 2010 report, Niagara Mohawk has partnered with The University at Buffalo's School of Engineering and Applied Science (Energy Systems Institute) to better understand the stray voltage findings in the City of Buffalo. The University at Buffalo has recently finalized its study of stray voltage in the City of Buffalo, a copy of which is attached for review. The study recommends, among other things, that the "current 1V limit [be] raised to a more realistic and appropriate, and yet safe, level of 8V. As noted above, the majority of the 2011 findings were below 4.5v in Albany (70%), Niagara Falls (91%), and Buffalo (78% in Scan 1 and 84% in Scan 2).

[3] The estimated manual testing costs are based on the per unit cost of conducting a manual elevated voltage test in Albany, Niagara Falls, and Buffalo and the number of facilities scanned during mobile testing in 2011. The numbers reflect what it would have cost the Company had it performed manual testing in these cities in 2011.

Appendix A
Mobile Testing & Repair Summary

NY Stray Voltage Mobile Testing Summary Report 2011 11/28/2011					
	Buffalo Scan 1	**Buffalo Scan 2**	**N. Falls**	**Albany**	***Grand Total***
Testing Summary					
Total Number of Events	714	566	47	148	**1,475**
At or Above 4.5 Volts	141	91	4	44	**280**
Below 4.5 Volts	573	475	43	104	**1,195**
Total NGRID Owned Events (streetlights)	660	534	46	135	**1,375**
At or Above 4.5 Volts	123	80	4	41	**248**
Below 4.5 Volts	537	454	42	94	**1,127**
Total Private Owned Events	54	32	1	13	**100**
At or Above 4.5 Volts	18	11	0	3	**32**
Below 4.5 Volts	36	21	1	10	**68**
Survey Percent Complete by City					
Buffalo	1441	1315			**100.00%**
Niagara Falls			36		**100.00%**
Albany				227	**100.00%**
Total Miles To Be Scanned (estimates)	1,441	1,315	36	227	**3,019**

NY Stray Voltage Mobile Testing Repair Summary Report 2011 11/28/2011					
	Buffalo Scan 1	**Buffalo Scan 2**	**N. Falls**	**Albany**	***Grand Total***
Repair Summary					
NGRID Repairs					
Required	660	534	46	135	**1,375**
Completed	660	528	44	118	**1,350**
Pending (All repairs)	0	6	2	17	**25**
Pending (De-energized streetlights)	0	2	0	5	**7**
Exceeding 45 Days	1	4	11	0	**16**
Percent Complete	100.00%	98.88%	95.65%	87.41%	**98.18%**
TOH Repairs	28	16	2	2	**48**
TOH Complete	27	8	0	2	**37**
TOH Pending	1	8	2	0	**11**
TOH Exceeding 90 Days	0	0	0	0	**0**
TOH Percent Complete	96.43%	50.00%	0.00%	100.00%	**77.08%**
Private Repairs					
Required	54	32	1	13	**100**
Completed	53	31	1	12	**97**
Pending	1	1	0	1	**3**
Exceeding 45 Days	0	0	0	0	**0**
Percent Complete	98.15%	96.88%	100.00%	92.31%	**97.00%**
Total Repairs Pending	1	7	2	18	**28**
Total Repairs Complete	713	559	45	130	**1,447**
Total Repairs Percent Complete	99.86%	98.76%	95.74%	87.84%	**98.10%**

Appendix B

Summary of Energized Objects - Mobile Testing - City of Albany

nationalgrid Data as of November 28, 2011	Initial Readings				Readings After Mitigation		
	1 - 4.4 V	4.5 - 24.9 V	> 25 V	Total	< 1 V	1 - 4.4 V	> 4.5 V
Distribution Facilities	0	0	0	0	0	0	0
Pole (910)	0	0	0	0	0	0	0
Ground (914)	0	0	0	0	0	0	0
Guy (915)	0	0	0	0	0	0	0
Riser (916)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Underground Facilities	0	0	0	0	0	0	0
Handhole / Pull box (950)	0	0	0	0	0	0	0
Manhole (951)	0	0	0	0	0	0	0
Padmount Switchgear (952)	0	0	0	0	0	0	0
Padmount Transformer (953)	0	0	0	0	0	0	0
Vault – Cover/Door (954)	0	0	0	0	0	0	0
Pedestal	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Street Lights / Traffic Signals	96	38	3	137	137	0	0
Metal Street Light Pole (971/981)	91	38	3	132	132	0	0
Traffic Signal Pole (991)	4	0	0	4	4	0	0
Control Box (992)	1	0	0	1	1	0	0
Pedestrian Crossing Pole (993)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Substation Fences	0	0	0	0	0	0	0
Fence (995)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Transmission	0	0	0	0	0	0	0
Lattice Tower (931)	0	0	0	0	0	0	0
Pole (930)	0	0	0	0	0	0	0
Ground (933)	0	0	0	0	0	0	0
Guy (934)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Miscellaneous Facilities	8	2	1	11	11	0	0
Sidewalk	0	0	0	0	0	0	0
Gate/Fence/Awning*	0	0	0	0	0	0	0
Control Box	0	0	0	0	0	0	0
Scaffolding	0	0	0	0	0	0	0
Bus Shelter	0	0	0	0	0	0	0
Fire Hydrant	0	0	0	0	0	0	0
Phone Booth	0	0	0	0	0	0	0
Water Pipe	0	0	0	0	0	0	0
Riser	0	0	0	0	0	0	0
Other**	8	2	1	11	11	0	0
Totals	104	40	4	148	148	0	0

*Includes railing

**Including but not limited to manhole cover, sewer cover, no parking sign, parking meter, private sign, stop sign, storm grate.

Appendix C

Summary of Energized Objects - Mobile Testing - City of Niagara Falls

nationalgrid
Data as of November 28, 2011

	Initial Readings				Readings After Mitigation		
	1 - 4.4 V	4.5 - 24.9 V	> 25 V	Total	< 1 V	1 - 4.4 V	> 4.5 V
Distribution Facilities	0	0	0	0	0	0	0
Pole (910)	0	0	0	0	0	0	0
Ground (914)	0	0	0	0	0	0	0
Guy (915)	0	0	0	0	0	0	0
Riser (916)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Underground Facilities	0	0	0	0	0	0	0
Handhole / Pull box (950)	0	0	0	0	0	0	0
Manhole (951)	0	0	0	0	0	0	0
Padmount Switchgear (952)	0	0	0	0	0	0	0
Padmount Transformer (953)	0	0	0	0	0	0	0
Vault – Cover/Door (954)	0	0	0	0	0	0	0
Pedestal	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Street Lights / Traffic Signals	43	4	0	47	47	0	0
Metal Street Light Pole (971/981)	42	4	0	46	46	0	0
Traffic Signal Pole (991)	1	0	0	1	1	0	0
Control Box (992)	0	0	0	0	0	0	0
Pedestrian Crossing Pole (993)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Substation Fences	0	0	0	0	0	0	0
Fence (995)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Transmission	0	0	0	0	0	0	0
Lattice Tower (931)	0	0	0	0	0	0	0
Pole (930)	0	0	0	0	0	0	0
Ground (933)	0	0	0	0	0	0	0
Guy (934)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Miscellaneous Facilities	0	0	0	0	0	0	0
Sidewalk	0	0	0	0	0	0	0
Gate/Fence/Awning*	0	0	0	0	0	0	0
Control Box	0	0	0	0	0	0	0
Scaffolding	0	0	0	0	0	0	0
Bus Shelter	0	0	0	0	0	0	0
Fire Hydrant	0	0	0	0	0	0	0
Phone Booth	0	0	0	0	0	0	0
Water Pipe	0	0	0	0	0	0	0
Riser	0	0	0	0	0	0	0
Other**	0	0	0	0	0	0	0
Totals	43	4	0	47	47	0	0

*Includes railing
**Including but not limited to manhole cover, sewer cover, no parking sign, parking meter, private sign, stop sign, storm grate.

Appendix D

Summary of Energized Objects - Mobile Testing - City of Buffalo Scan 1

nationalgrid Data as of November 28, 2011	Initial Readings				Readings After Mitigation		
	1 - 4.4 V	4.5 - 24.9 V	> 25 V	Total	< 1 V	1 - 4.4 V	> 4.5 V
Distribution Facilities	0	0	0	0	0	0	0
Pole (910)	0	0	0	0	0	0	0
Ground (914)	0	0	0	0	0	0	0
Guy (915)	0	0	0	0	0	0	0
Riser (916)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Underground Facilities	0	0	0	0	0	0	0
Handhole / Pull box (950)	0	0	0	0	0	0	0
Manhole (951)	0	0	0	0	0	0	0
Padmount Switchgear (952)	0	0	0	0	0	0	0
Padmount Transformer (953)	0	0	0	0	0	0	0
Vault – Cover/Door (954)	0	0	0	0	0	0	0
Pedestal	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Street Lights / Traffic Signals	556	118	12	686	680	2	4
Metal Street Light Pole (971/981)	536	113	9	658	654	0	4
Traffic Signal Pole (991)	20	4	3	27	25	2	0
Control Box (992)	0	1	0	1	1	0	0
Pedestrian Crossing Pole (993)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Substation Fences	0	0	0	0	0	0	0
Fence (995)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Transmission	0	0	0	0	0	0	0
Lattice Tower (931)	0	0	0	0	0	0	0
Pole (930)	0	0	0	0	0	0	0
Ground (933)	0	0	0	0	0	0	0
Guy (934)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Miscellaneous Facilities	17	6	5	28	28	0	0
Sidewalk	1	0	0	1	1	0	0
Gate/Fence/Awning*	0	0	0	0	0	0	0
Control Box	0	0	0	0	0	0	0
Scaffolding	0	0	0	0	0	0	0
Bus Shelter	2	1	1	4	4	0	0
Fire Hydrant	0	0	0	0	0	0	0
Phone Booth	0	0	0	0	0	0	0
Water Pipe	0	0	0	0	0	0	0
Riser	0	0	0	0	0	0	0
Other**	14	5	4	23	23	0	0
Totals	573	124	17	714	708	2	4

*Includes railing

**Including but not limited to manhole cover, sewer cover, no parking sign, parking meter, private sign, stop sign, storm grate.

Appendix E

Summary of Energized Objects - Mobile Testing - City of Buffalo Scan 2

nationalgrid Data as of November 28, 2011	Initial Readings				Readings After Mitigation		
	1 - 4.4 V	4.5 - 24.9 V	> 25 V	Total	< 1 V	1 - 4.4 V	> 4.5 V
Distribution Facilities	0	0	0	0	0	0	0
Pole (910)	0	0	0	0	0	0	0
Ground (914)	0	0	0	0	0	0	0
Guy (915)	0	0	0	0	0	0	0
Riser (916)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Underground Facilities	0	0	0	0	0	0	0
Handhole / Pull box (950)	0	0	0	0	0	0	0
Manhole (951)	0	0	0	0	0	0	0
Padmount Switchgear (952)	0	0	0	0	0	0	0
Padmount Transformer (953)	0	0	0	0	0	0	0
Vault – Cover/Door (954)	0	0	0	0	0	0	0
Pedestal	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Street Lights / Traffic Signals	463	80	7	550	548	2	0
Metal Street Light Pole (971/981)	451	73	7	531	531	0	0
Traffic Signal Pole (991)	11	7	0	18	16	2	0
Control Box (992)	1	0	0	1	1	0	0
Pedestrian Crossing Pole (993)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Substation Fences	0	0	0	0	0	0	0
Fence (995)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Transmission	0	0	0	0	0	0	0
Lattice Tower (931)	0	0	0	0	0	0	0
Pole (930)	0	0	0	0	0	0	0
Ground (933)	0	0	0	0	0	0	0
Guy (934)	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Miscellaneous Facilities	12	3	1	16	14	2	0
Sidewalk	1	0	0	1	1	0	0
Gate/Fence/Awning*	0	0	0	0	0	0	0
Control Box	0	0	0	0	0	0	0
Scaffolding	0	0	0	0	0	0	0
Bus Shelter	1	2	0	3	3	0	0
Fire Hydrant	0	0	0	0	0	0	0
Phone Booth	0	0	0	0	0	0	0
Water Pipe	0	0	0	0	0	0	0
Riser	0	0	0	0	0	0	0
Other**	10	1	1	12	10	2	0
Totals	475	83	8	566	562	4	0

*Includes railing

**Including but not limited to manhole cover, sewer cover, no parking sign, parking meter, private sign, stop sign, storm grate.

Street Light Stray Voltage Investigation

Final Report

Energy Systems Institute
University at Buffalo
4/29/2011

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ABSTRACT

The University at Buffalo's Energy Systems Institute has investigated the occurrence of stray voltage in the City of Buffalo. The street light circuits have been the cause of many neutral-earth elevated voltages to develop on street light standards. In 2009 testing revealed 2556 occurrences, or light standards with voltages greater than 1V. In 2010, the same scanning area produced 931 occurrences. The causes of stray voltage were studied and analyzed using computer circuit modeling programs. The results of the computer simulations indicate that imbalances caused by corroded cabling, phase faults, and load mismatches result in neutral-earth elevated voltages on bonded light standards. The 4-wire system has been recommended as it solves many, but not all, stray voltage situations. A discussion on electrical safety is provided that aims to derive appropriate stray voltage limits. It was found that the variability in contact resistance (hand-light standard, foot-ground) plays a large role making it difficult to establish an explicit number. However, it was determined that current stray voltage limits have several safety factors built in, to the point that they may be excessively high. Other recommendations to the utilities include advanced record keeping to aid with future diagnostics and troubleshooting to reduce both down time and cost.

I. INTRODUCTION

The growth of the electrical utility distribution system over the years has not been without its complications. One issue that has gained some traction in recent years is neutral-elevated voltages (NEV), which is known more colloquially as stray voltage. The history of stray voltage extends back many years with the earliest complaints generated out of the mid-west farming industry. In response to farmers complaints of decreased milk production and the negative behavioral responses of cows in milking parlors, scientists conducted a study to investigate the effect that electrical current had on the cows [1]. The results corroborated the general mentality amongst the dairy farmers that the stray voltage was having an impact on the behavior of the cows. Armed with the results of the study, the dairy farmers lobbied the Wisconsin legislation which ultimately ruled in their favor by mandating that the utilities limit stray voltage to less than 0.5V on dairy farms [2]. Other states would soon enough sanction limits following similar law suits. Up to this point, the concern over stray voltage was seemingly isolated to dairy farmers; it was not until early in the 21st century that stray voltage discussion began in the context of metropolitan areas. The legislation of stray voltage on dairy farms was seemingly used as a precedent in much of the regulation the utilities face today regarding stray voltage in many of America's cities.

Stray voltage has been used as a general blanket term by the public, legislators, and even the utilities themselves to describe undesired voltages on objects that should not be energized. It is very important, however, to identify the appropriate nomenclature to avoid confusion. The Institute of Electrical and Electronics Engineers (IEEE) has established a working group to define stray voltage.

This group defines stray voltage as:

> ***Stray Voltage:*** *A voltage resulting from the normal delivery and/or use of electricity (usually smaller than 10 volts) that may be present between two conductive surfaces that can be simultaneously contacted by members of the general public and/or their animals. Stray voltage is caused by primary and/or secondary return current, and power system induced currents, as these currents flow through the impedance of the intended return pathway, its parallel conductive pathways, and conductive loops in close proximity to the power system. Stray voltage is not related to power system faults, and is generally not considered hazardous.* [3]

Contact voltage is another type of elevated voltage that can occur on a metal object that is often confused with stray voltage. The IEEE working group on stray voltage defines contact voltages as the following:

> ***Contact Voltage:*** *A voltage resulting from abnormal power system conditions that may be present between two conductive surfaces that can be simultaneously contacted by members of the general public and/or their animals. Contact voltage is caused by power system fault current as it flows through the impedance of available fault current pathways. Contact voltage is not related to normal system operation and can exist at levels that may be hazardous.*[3]

Stray voltage can develop on any metallic object such as guard rails, street signs, man-hole covers, and street light standards. In the Buffalo metropolitan area, street light circuits have been the main cause of stray voltage occurrence. The analysis and discussion of this document will therefore be limited to street light related stray voltage.

The following section will discuss some of the main causes of stray voltage and several simulation cases are presented. An overview of government regulation of stray voltage is presented in section III which illustrates the history of legislation in many states. Much of the current legislation is based on a defined safety threshold. These safety thresholds are discussed

in detail in section IV to shed light on what an appropriate safety limit should be from a regulation standpoint. Lastly, this work is summarized in V which provides some general recommendations based on the conclusion of this work.

II. STRAY VOLTAGE ANALYSIS

The root cause of many stray voltage issues are the result of an imbalance in the neutral return path of the light circuit. However, there could be several reasons why a circuit becomes imbalanced which makes diagnosing stray voltage problems particularly difficult. The imbalances can occur if the underground cabling becomes compromised in any way. Underground cabling is prone to the long term effects of multifactor stress aging which results in insulation breakdown and eventually failure. Corrosion also usually occurs at connection points within the light standard itself. The corrosion can raise the overall impedance of the connection which will change the characteristics of the overall circuit. Human factors also play a role in contributing to circuit imbalances, including construction or road crews that recklessly drive posts or signs into the ground causing faults or otherwise damage the cabling. Additionally, construction projects such as the addition or modification of roadways or walking paths sometimes require light standards to be relocated to other circuits. These modified circuits no longer match their original design and therefore could suffer from imbalances. Another, albeit continuously variable, contributor is environmental conditions. The moisture content, temperature, and composition of the soil will determine how conductive it is. A poorly insulated cable in cool and dry soil conditions will behave differently than if it were buried in an area that was warm and moist.

A. Simulations

In order to analyze how various imbalances produce stray voltage, various simulations were carried out. The circuit simulation and analysis package that was used was Orcad PSPICE® 9.2 Lite Edition. The physical layout of the circuit is shown in Figure 1 which shows a transformer feeding 8 street lights.

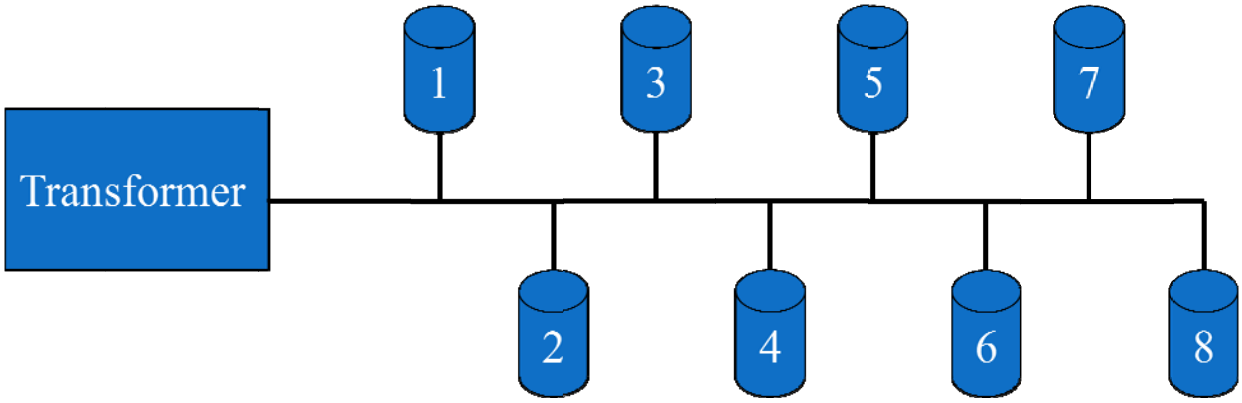

Figure 1: Physical layout representation of street light circuit.

The number of street lights was limited to 8 for all the simulations performed due to the constraints of the program. This layout is represented schematically in Figure 2.

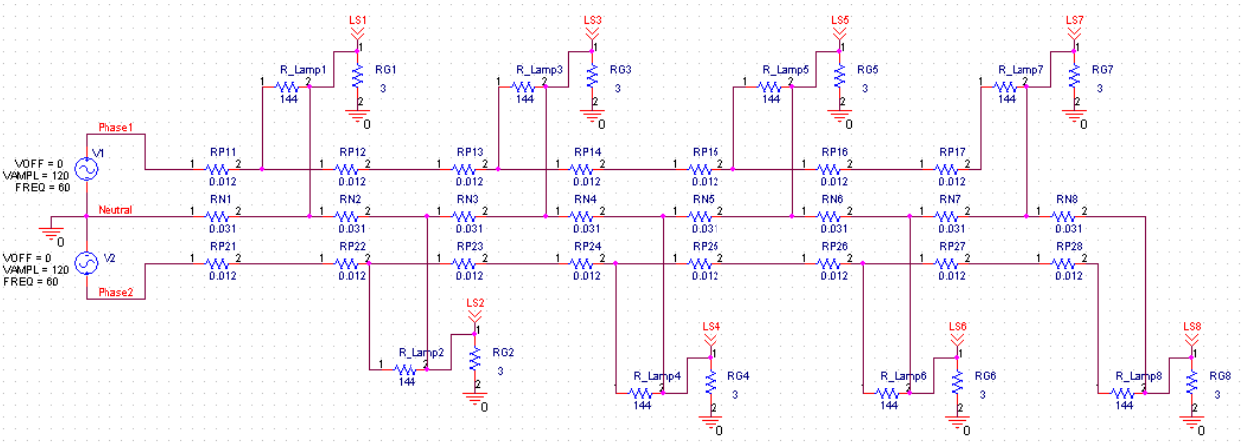

Figure 2: Schematic representation of a balanced street light circuit with 8 lamps

The center tap transformer feed provides two phases or "hot legs" which are 180° out of phase, and a grounded neutral. In an ideal case, every other street light would be powered of the same phase (ie lights 1,3,5,7 are on phase 1 and lights 2,4,6,8 are on phase 2). In this configuration the light circuit will be as balanced as possible. The simulation factors in the various cabling resistances which are shown in Figure 2. The cable resistances are based on the assumption that the length of cable between light standards is 50ft. The two phase cables are assumed to be 4AWG insulated copper with a dc impedance of 0.012Ω for the 50ft. length. The neutral cables are assumed to be 8AWG insulated copper with a dc impedance of 0.031Ω for the 50ft. length. The ground rod resistance was assumed to be 3Ω [4] which includes the ground rod/earth interface resistance. The voltage sources were set to 120V ac with a frequency of 60Hz and the lamps are assumed to be 100W units (144Ω impedance).

1. Sim case 1 - Balanced configuration

The balanced configuration was considered a baseline simulation case. The configuration was shown in Figure 1 and is considered the ideal case. The results of the simulation are shown in Figure 3 through Figure 6.

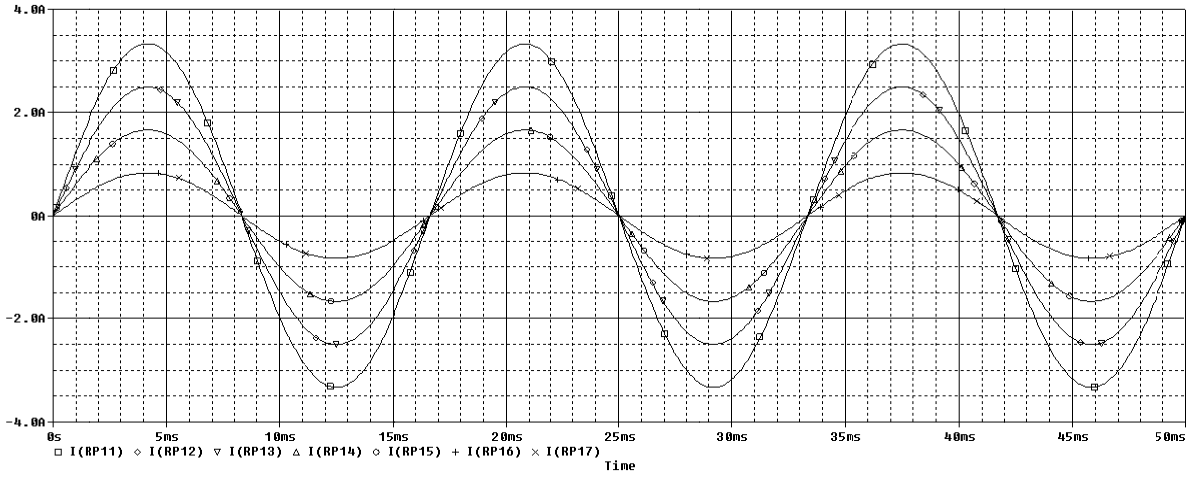

Figure 3: Sim case 1 (Balanced configuration) - phase 1 currents

Figure 3 and 4 show the phase 1 and phase 2 currents of the baseline simulation. The currents are nearly identical in magnitude and the light standards closest to the transformer have larger currents.

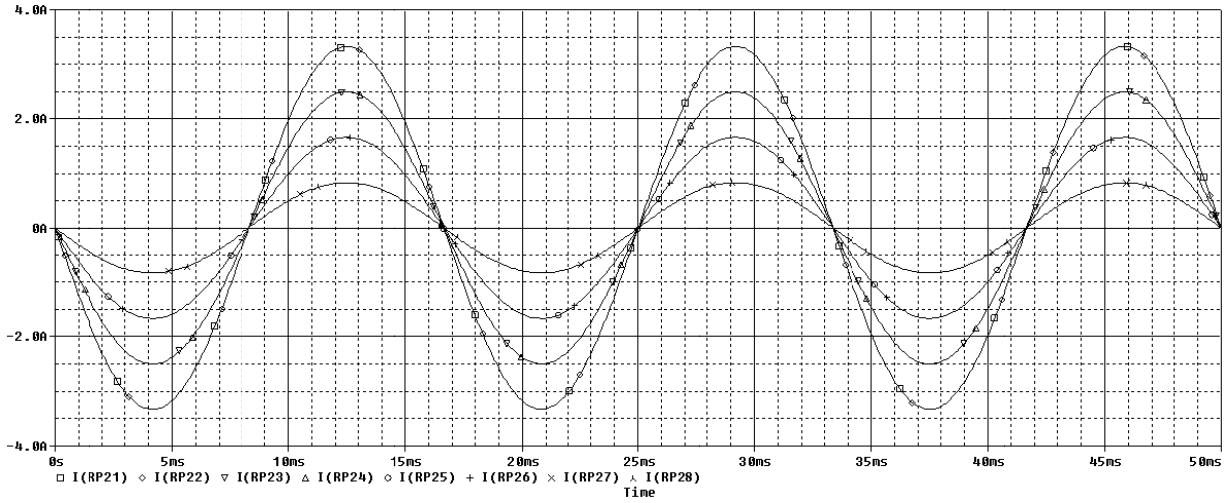

Figure 4 Sim case 1 (Balanced configuration) - phase 2 currents

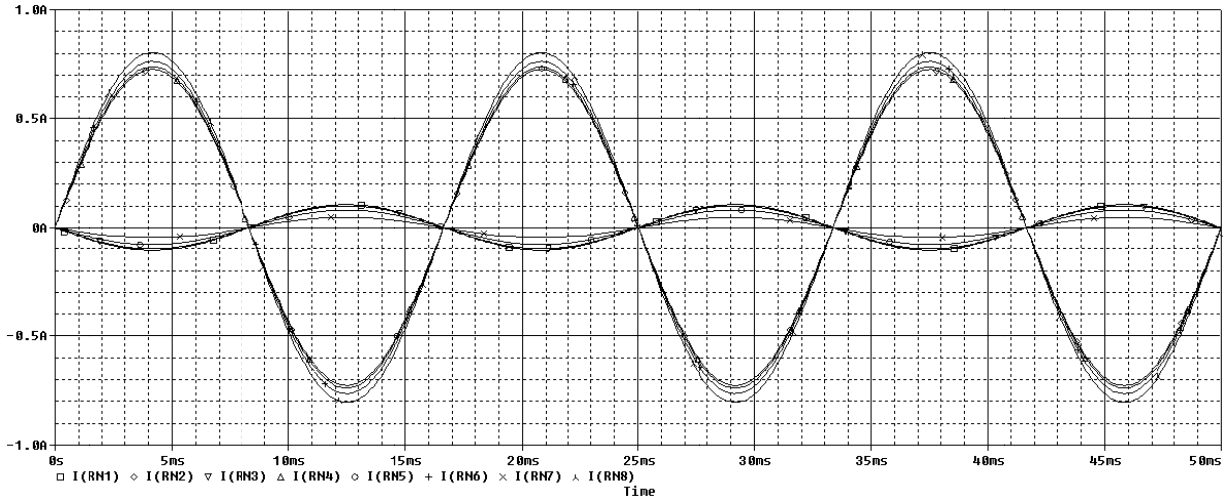

Figure 5 Sim case 1 (Balanced configuration) - neutral currents

Figure 5 and 6 show the neutral currents and the stray voltage on the light standard respectively. The neutral currents for the baseline configuration are approximately 0.75A for lights 2, 4, 6, and 8, and approximately 0.1A for lights 1, 3, 5, and 7. The light standards positioned closer to the transformer (ie lights 1, 2, 3) have lower stray voltages compared to the light standards furthest away (ie lights 6, 7, 8). All light standards however, are less than 90mV.

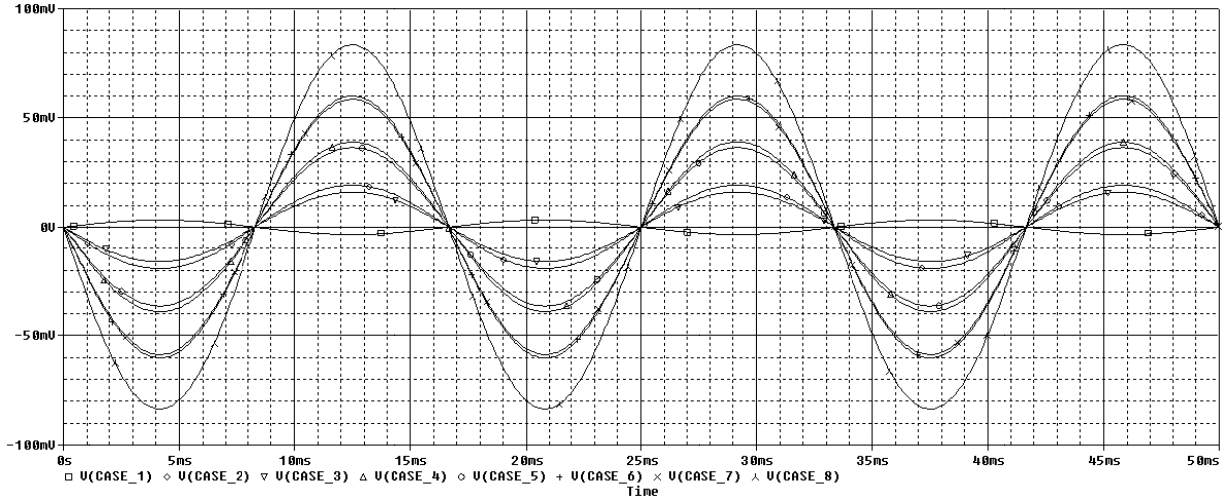

Figure 6 Sim case 1 (Balanced configuration) - voltage on light standard (stray voltage)

2. Sim case 2 - Unbalanced configuration

The unbalanced configuration is similar to that shown in Figure 1 except that lights 1-7 are powered off of phase 1 and lamp 8 is powered off of phase 2. This situation creates a "design imbalance" since the circuit has been hard wired in this configuration. These results are shown in Figure 7 through Figure 10.

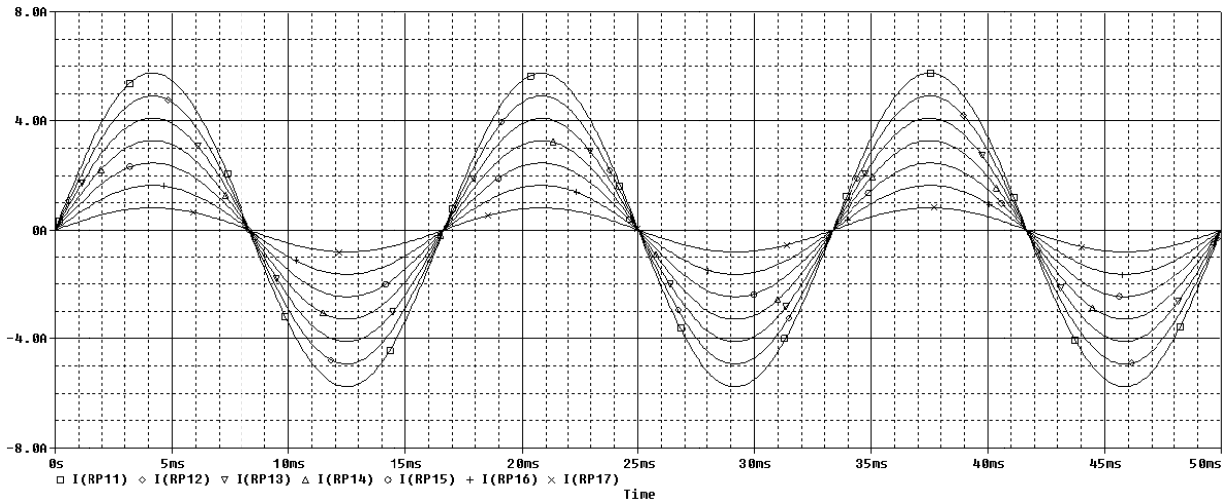

Figure 7 Sim case 2 (unbalanced configuration) - phase 1 currents

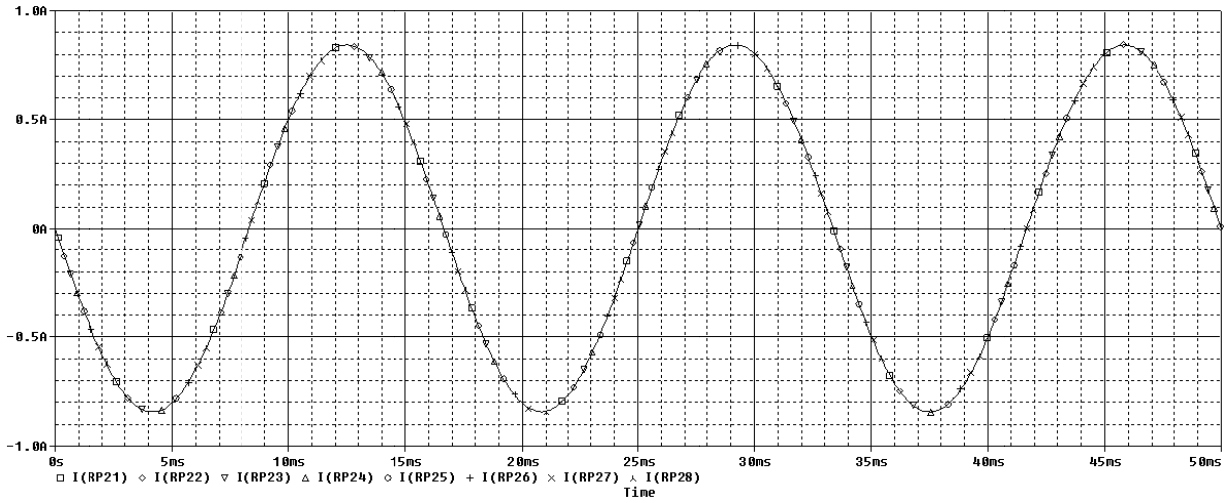

Figure 8 Sim case 2 (unbalanced configuration) - phase 2 currents

The phase 1 currents for the unbalanced configuration roughly doubled from the baseline case since it is powering almost all of the lights. Conversely, the phase 2 current was reduced since it was only powering one lamp.

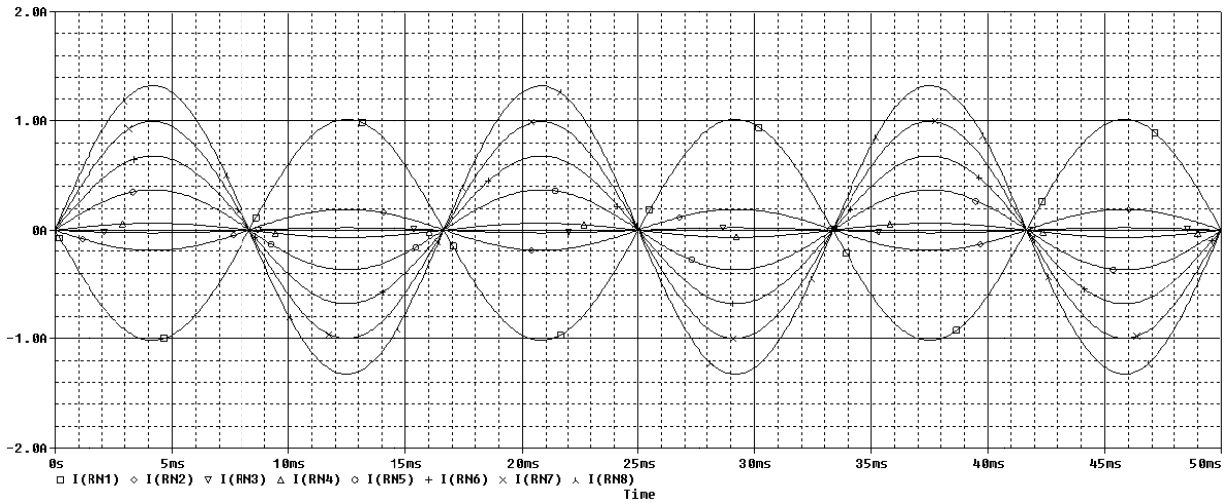

Figure 9 Sim case 2 (unbalanced configuration) - neutral currents

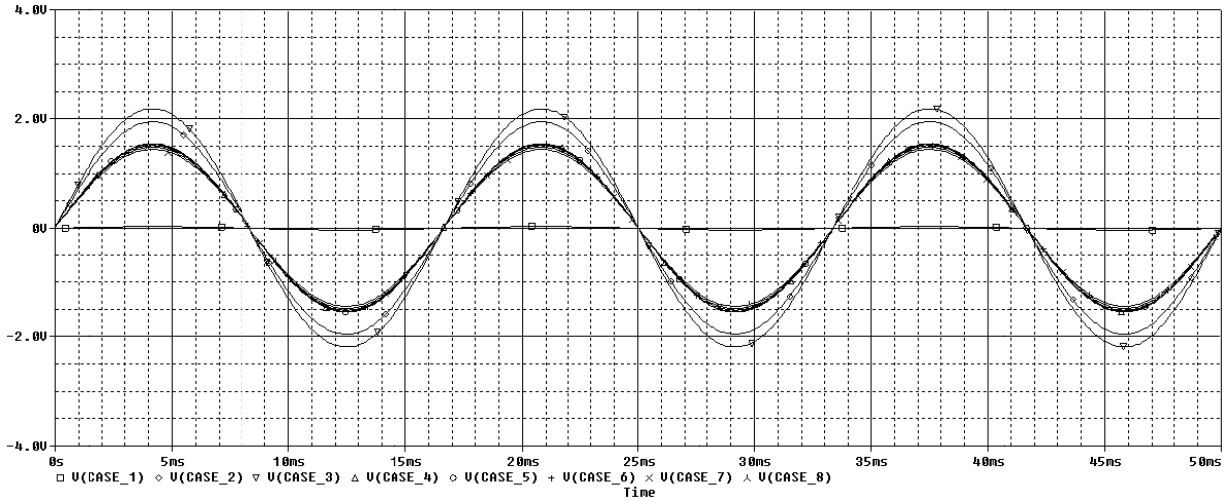

Figure 10 Sim case 2 (unbalanced configuration) - voltage on light standard (stray voltage)

The distribution of the neutral currents has changed significantly as well; the overall magnitudes have increased as well. The increase in the neutral currents has resulted in a voltage developing at the light standard. With the exception of the light standard closest to the transformer, the value of the stray voltages range from 1.5 - 2V on all other light standards.

3. *Sim case 3 - Corroded neutral (i)*

This simulation case represents situations where a section of neutral cable has corroded causing increased impedance for that particular length of cable. The corroded neutral impedance was assumed to be 100Ω and was positioned between light standards 1 and 2 as shown in Figure 11. The circuit is otherwise balanced; lights 1, 3, 5, and 7 are powered from phase 1 and the rest are on phase 2. The results of this simulation case are shown in Figure 12 through Figure 15.

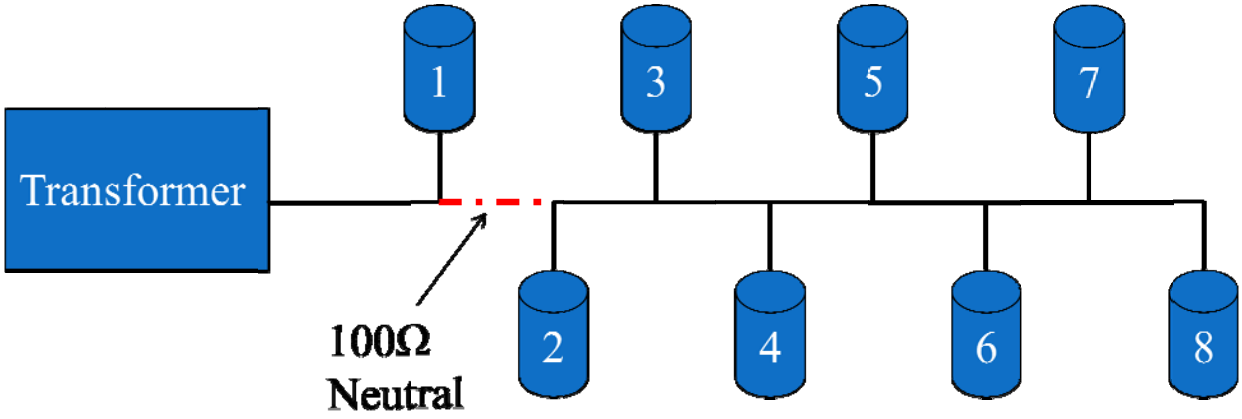

Figure 11 Representation of circuit layout showing the position of the corroded neutral.

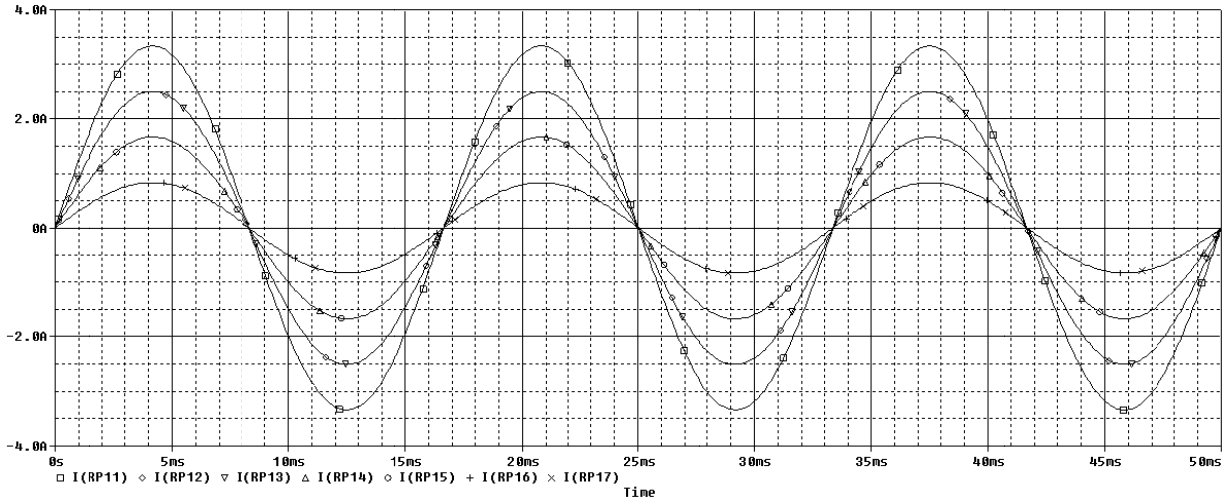

Figure 12 Sim case 3 (corroded neutral -i) - phase 1 currents

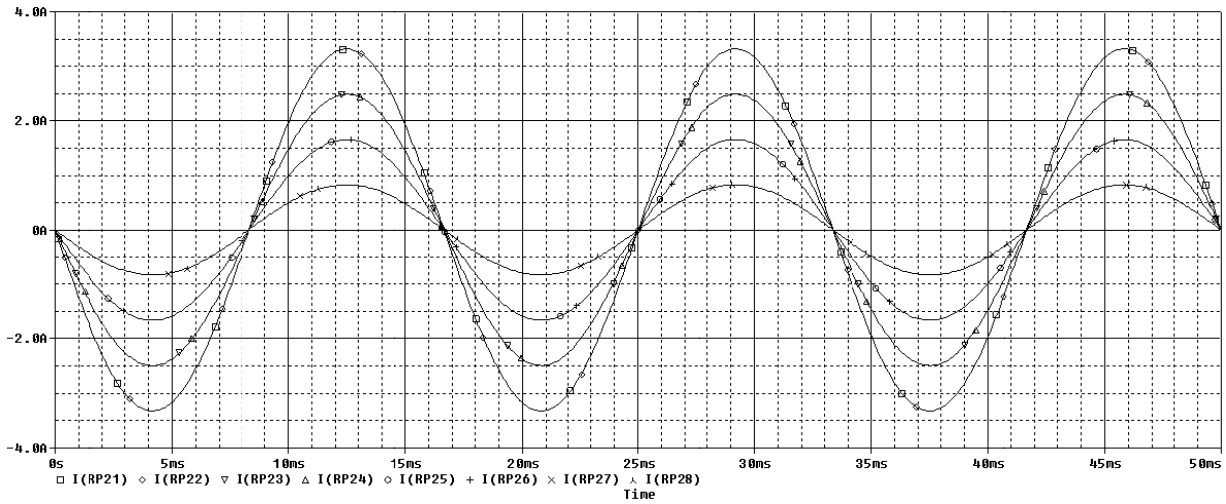

Figure 13 Sim case 3 (corroded neutral -i) - phase 2 currents

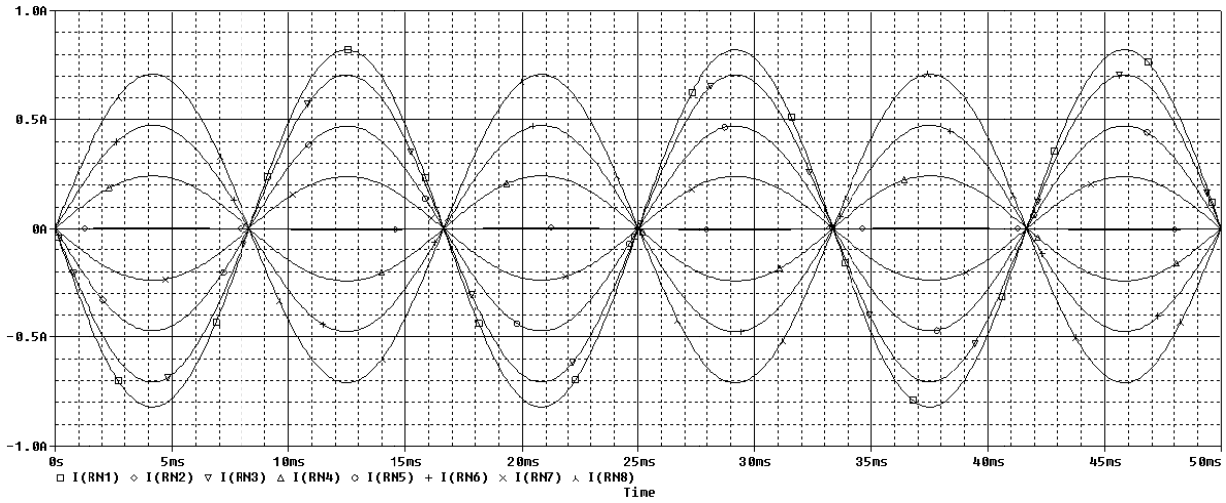

Figure 14 Sim case 3 (corroded neutral -i) - neutral currents

The phase 1 and phase 2 currents for this simulation case are nearly identical to the baseline case. However, since the corroded neutral was placed nearest the transformer, this has created a higher impedance path for the return currents. This resulted in the neutral current distribution to be more like sim case 2 rather than the baseline case, although the magnitudes are closer to the baseline case.

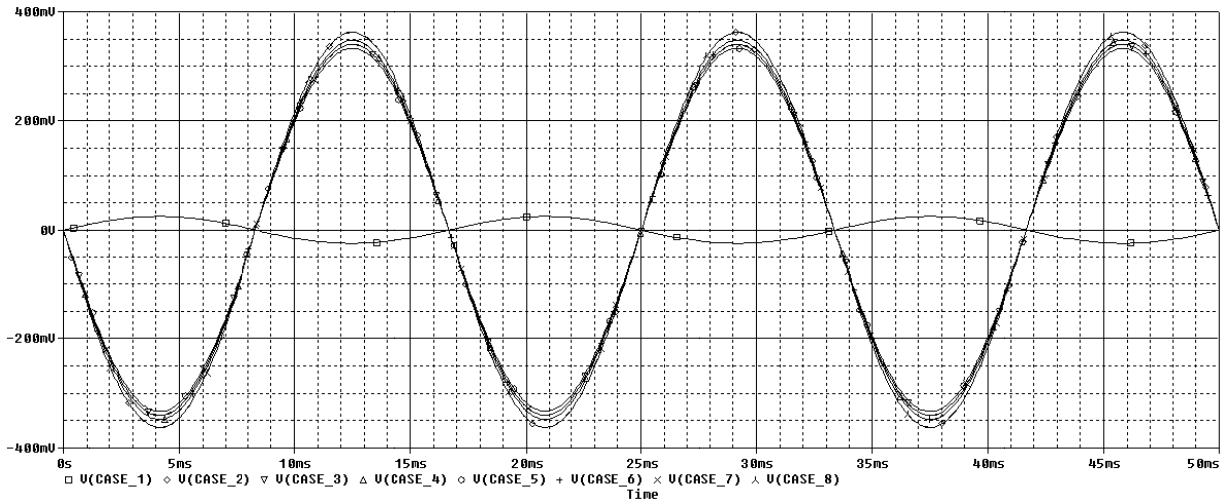

Figure 15 Sim case 3 (corroded neutral -i) - voltage on light standard (stray voltage)

The similar neutral current magnitudes resulted in the highest stray voltage value to rise from approximately 75mV in the baseline case to 350mV. The baseline stray voltage values, while lower, also decreased in magnitude with decreasing distance from the transformer. In this simulation case, the stray voltage present on all of the light standards located after the corroded neutral are of the same magnitude.

4. Sim case 4 - Corroded neutral (ii)

This simulation case is the same as simulation case 3 except the placement of the corroded neutral is placed between light standards 7 and 8 as shown in Figure 16.

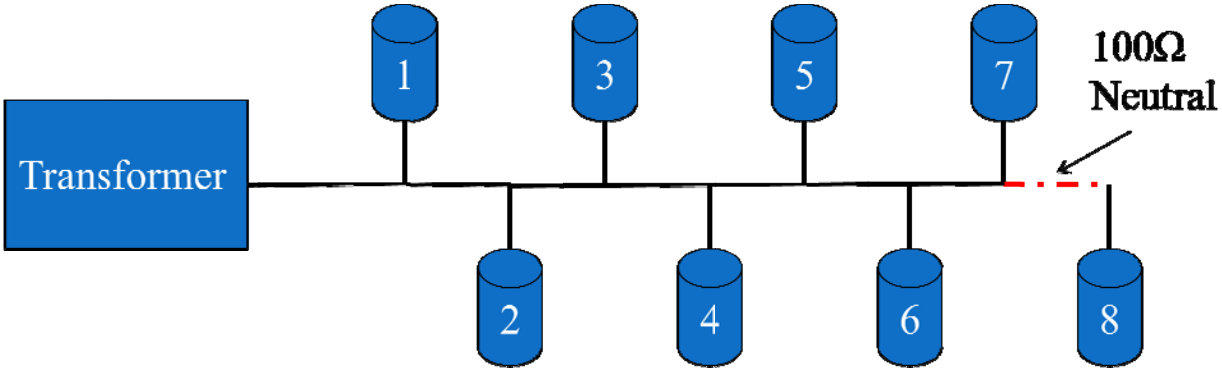

Figure 16 Representation of circuit layout showing the position of the corroded neutral.

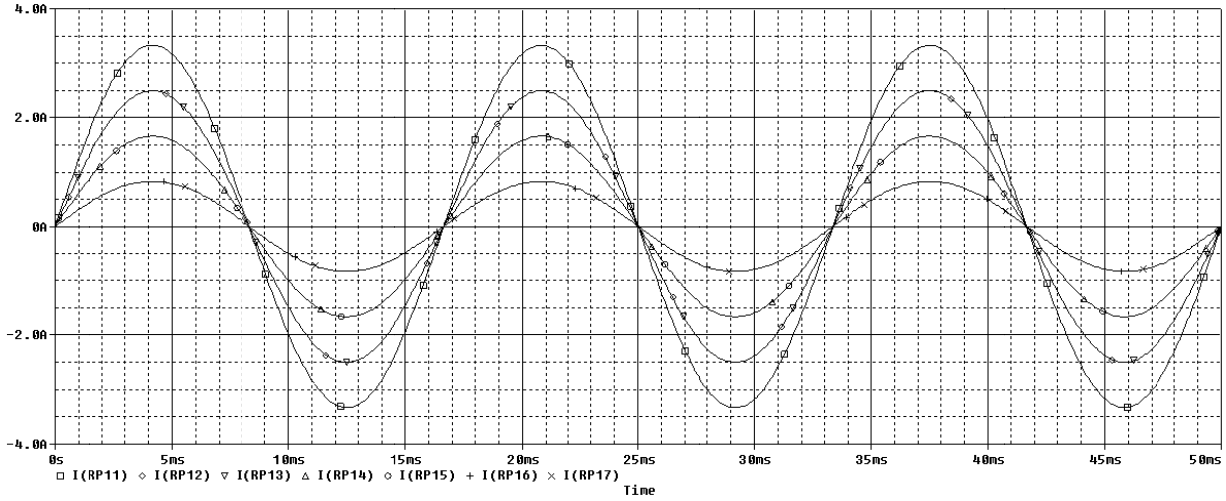

Figure 17 Sim case 4 (corroded neutral -ii) - phase 1 currents

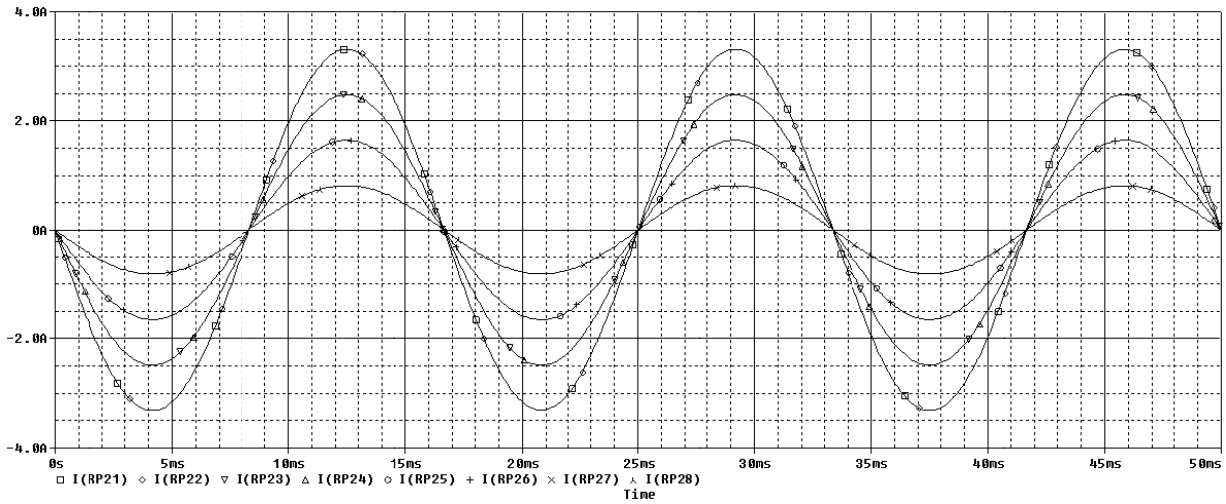

Figure 18 Sim case 4 (corroded neutral -ii) - phase 2 currents

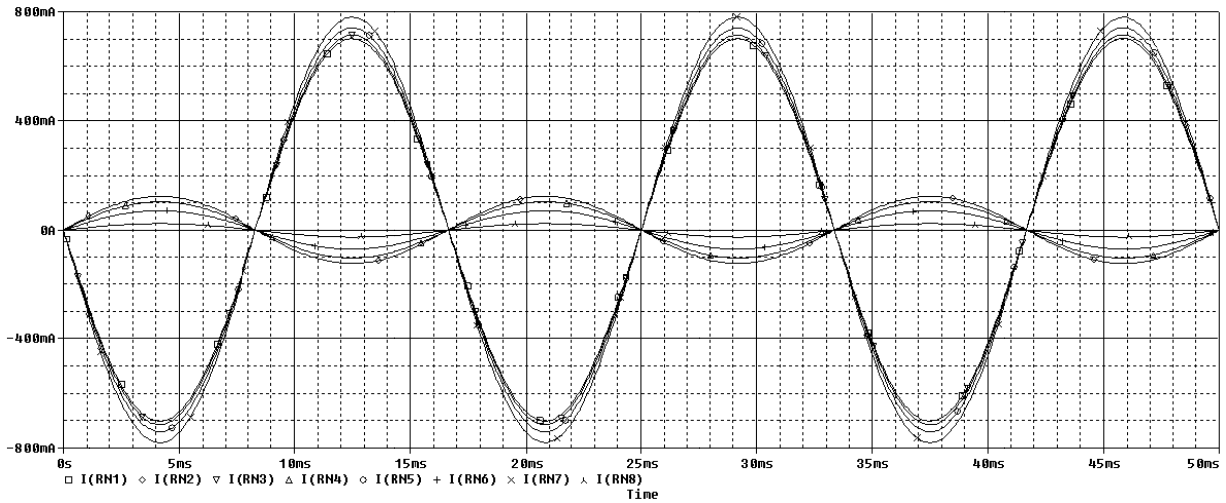

Figure 19 Sim case 4 (corroded neutral -ii) - neutral currents

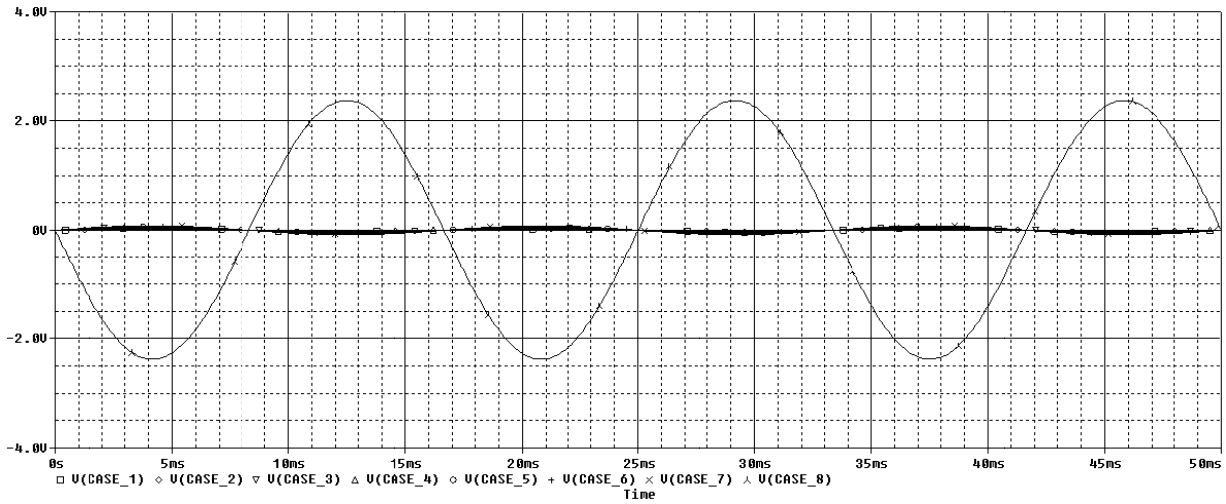

Figure 20 Sim case 4 (corroded neutral -ii) - voltage on light standard (stray voltage)

The phase currents again are the same as the baseline case and the distribution of neutral currents are closer to the baseline case rather than sim case 3. Since the location of the corroded neutral was far from the transformer the other neutral currents were not as affected compared to the previous simulation case. This translates into only a single elevated stray voltage on light standard 8 while the rest of the light standard voltages remain at low levels comparable to the baseline values.

5. Sim case 5 - Phase to ground fault (i)

This simulation considers the situation when one of the phases is faulted to ground due to some sort of insulation failure. The impedance of the fault is assumed to be 10Ω. The phases are balanced similar to simulation case 1 with the fault on phase 2 as shown in Figure 21. The results of this simulation are shown in Figure 22 through Figure 25.

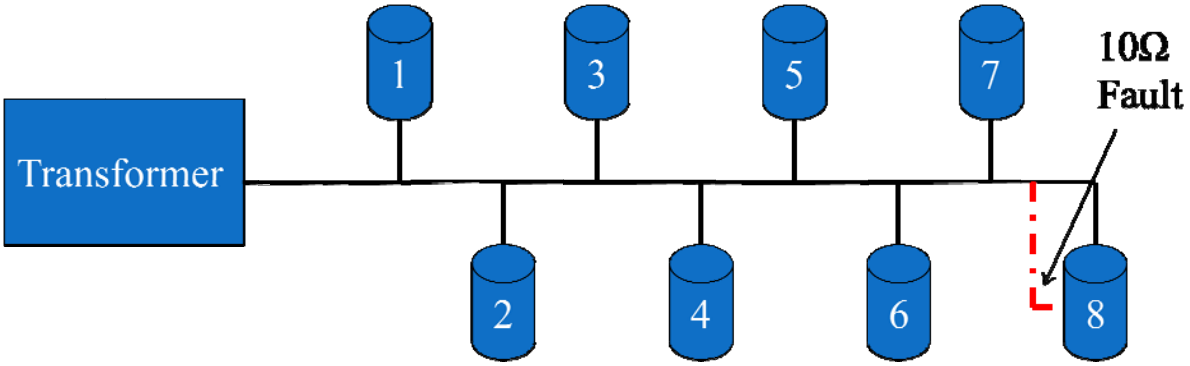

Figure 21 Representation of circuit layout showing the position of the fault on phase 2.

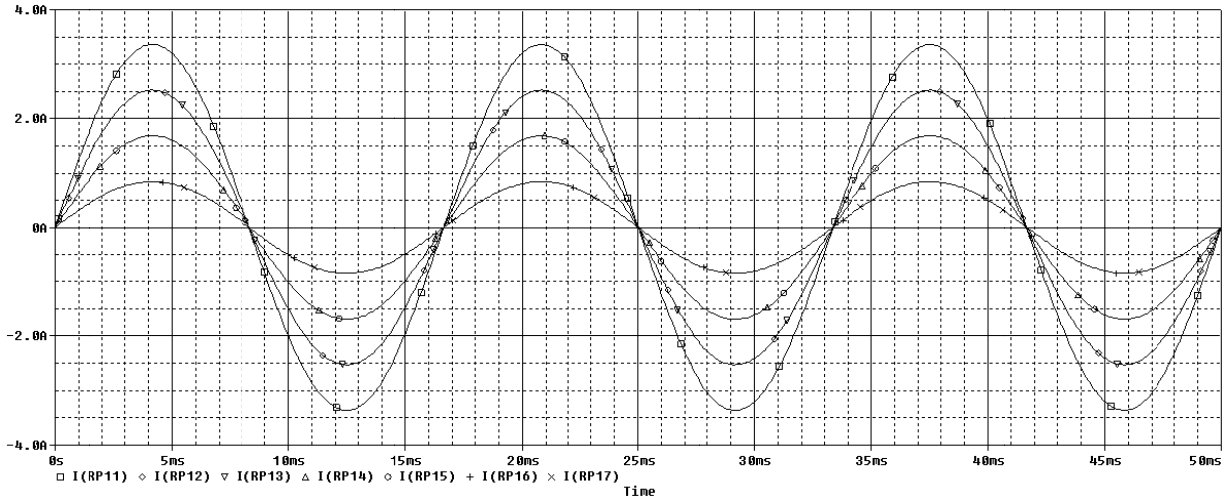

Figure 22 Sim case 5 (faulted phase -i) - phase 1 currents

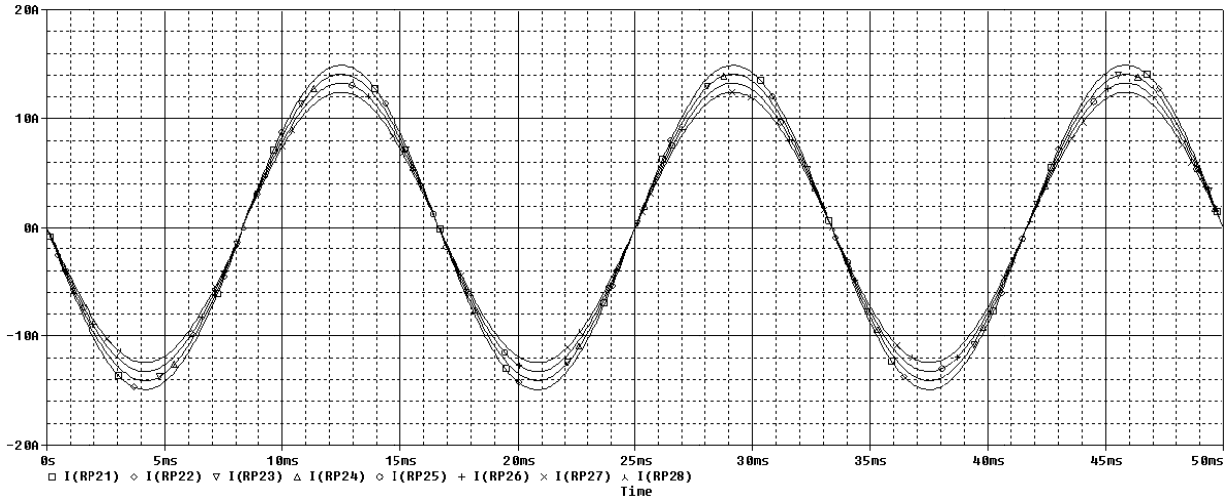

Figure 23 Sim case 5 (faulted phase -i) - phase 2 currents

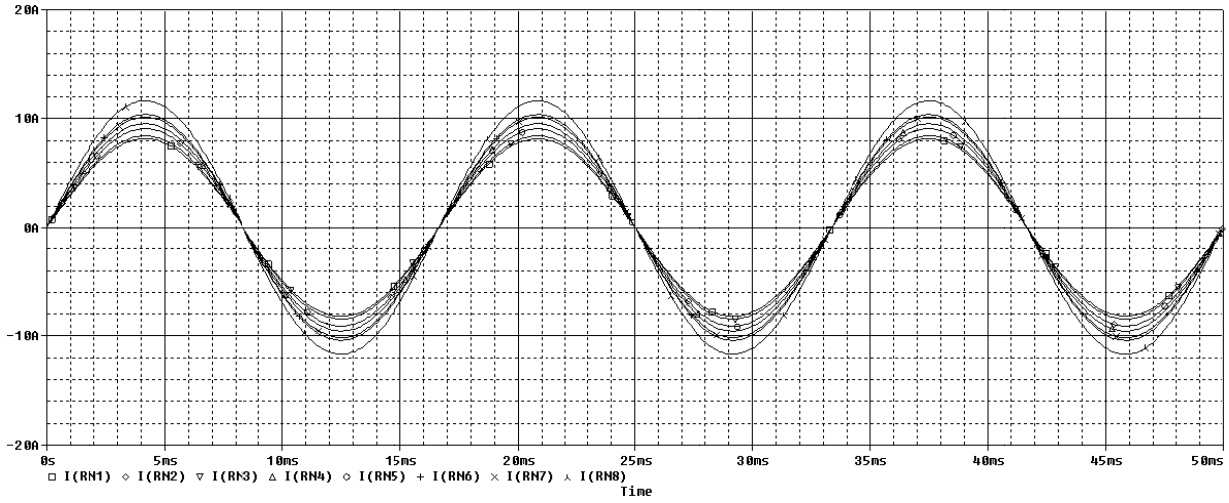

Figure 24 Sim case 5 (faulted phase -i) - neutral currents

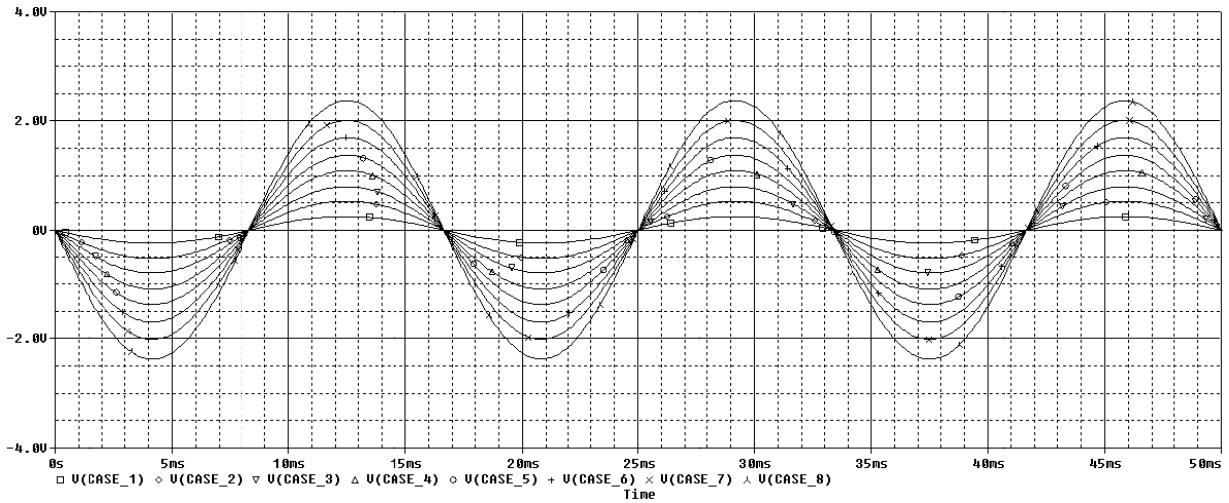

Figure 25 Sim case 5 (faulted phase - i) - voltage on light standard (stray voltage)

The phase 1 currents are unchanged from the baseline case as expected. The phase 2 currents are clearly higher due to the low impedance fault on phase 2. The neutral currents are therefore also considerably higher in magnitude as well with the average peak amplitude just

under 10A. The amplitude of the stray voltage on the light standards is highest near the location of the fault with a peak value of about 2.5V, while the peak amplitude nearest the transformer is only about 250mV.

6. Sim case 6 - Phase to ground fault (ii)

This simulation case is the same as simulation case 5 except the fault impedance has been reduced to a value of 1Ω. The results are shown in

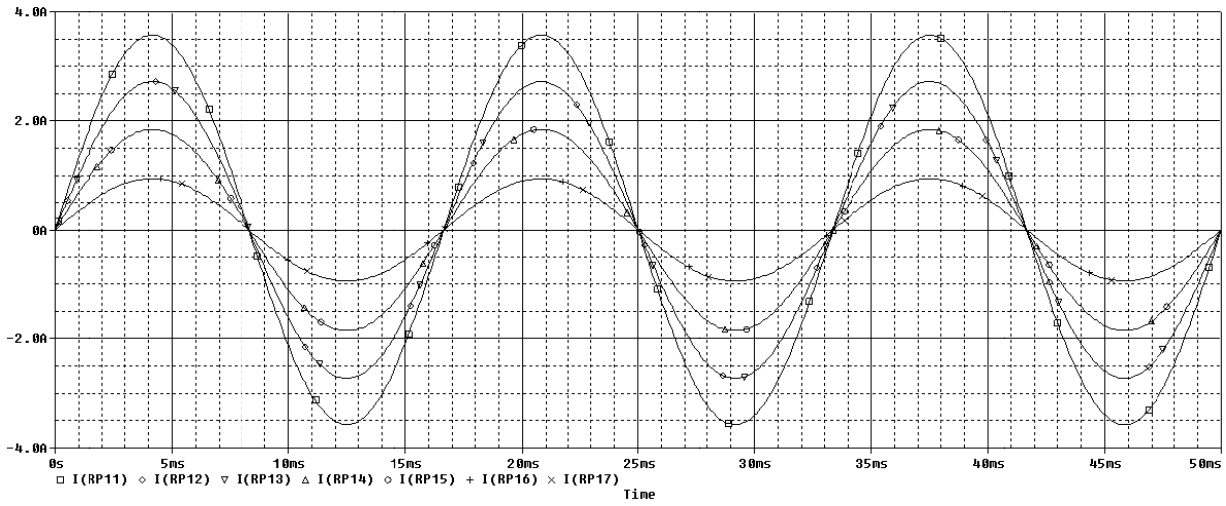

Figure 26 Sim case 6 (faulted phase - ii) - phase 1 currents

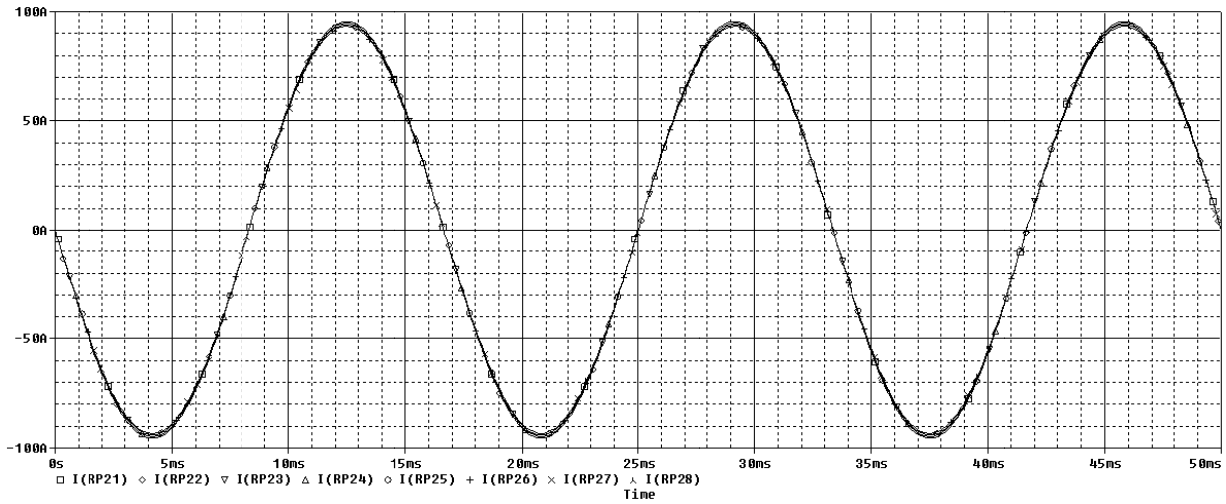

Figure 27 Sim case 6 (faulted phase - ii) - phase 2 currents

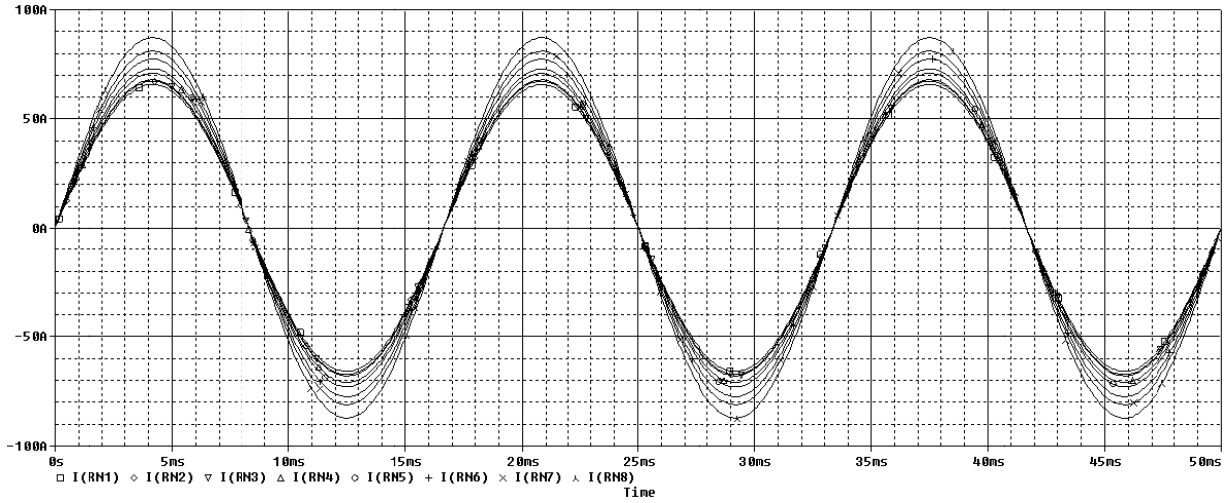

Figure 28 Sim case 6 (faulted phase - ii) - neutral currents

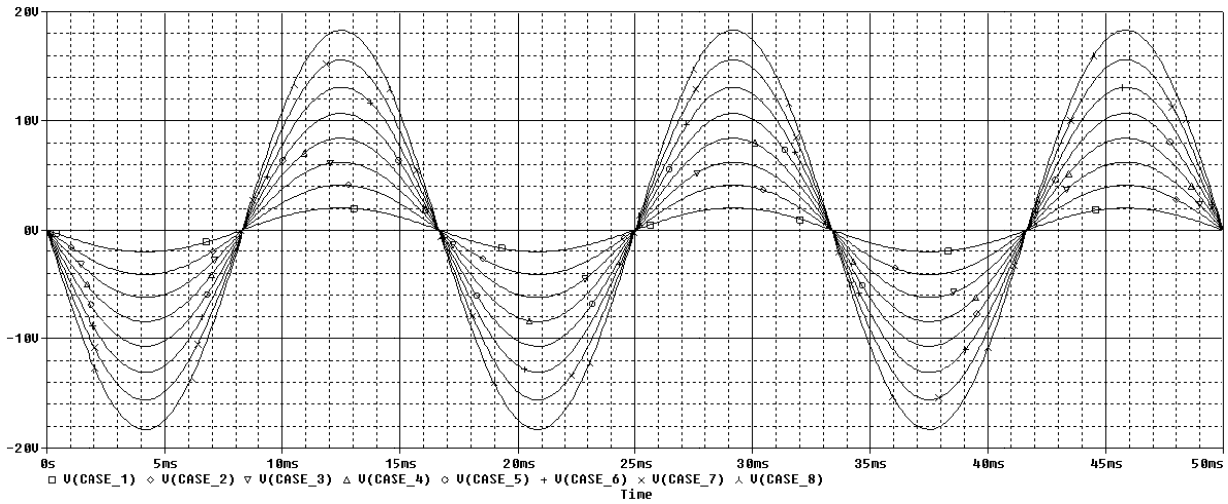

Figure 29 Sim case 6 (faulted phase - ii) - voltage on light standard (stray voltage)

The results of this simulation case follow the same trends and stray voltage distribution as sim case 5 only the magnitudes are higher. The phase 2 currents reported in the simulation are more than likely much higher than what would be allowed with the inline protection fuses. The simulation was done to show the effect of increased neutral currents on stray voltage.

The simulation cases presented in this section validate that various circuit imbalances can cause stray voltage. The circuit impedance values and other assumptions used in the simulations may not directly relate to what is seen in the field due to the variability of systems and of the surrounding environment. Therefore, the stray voltage values are shown only to demonstrate trends rather than absolute values under the simulation conditions detailed under each simulation case.

B. Stray voltage Mitigation methods

There are both short and long term corrective actions that can be taken to mitigate stray voltage. The short term fix is to remove the neutral-mechanical ground bond inside the light standard. This effectively isolates the light standard from the circuit. However, problems may still arise since the light standard is no longer grounded and may present a safety issue in the event of a line to standard fault.

A more appropriate long term solution is to use a 4-wire system (Figure 30). The fourth wire of this system is a mechanical ground that connects all of the local earth grounds at each light standard to the earth ground at the transformer. The advantage of this system is that the neutral no longer is bonded to the mechanical ground and therefore the light standard is not a part of the lighting circuit. However, safety is still maintained since the light standard still has a local ground rod attachment as well as a connection to earth at the transformer. The 4-wire system was not simulated because since there is no neutral-ground connection at each light standard, no stray voltage will develop under unbalanced conditions. This system essentially solves all stray voltage issues related to underground corrosion and insulation failure of neutrals and other imbalances in the circuit. Although, a line to light standard fault will still produce a voltage potential since a large current would be flowing along the mechanical ground wire. Inline fuses on the phase conductors should blow during excessive fault currents which would likely eliminate stray voltage occurrence during this type of fault condition. Additionally, circulating ground currents from other nearby sources could conduct to the ground rods connected to the light standard and produce a voltage.

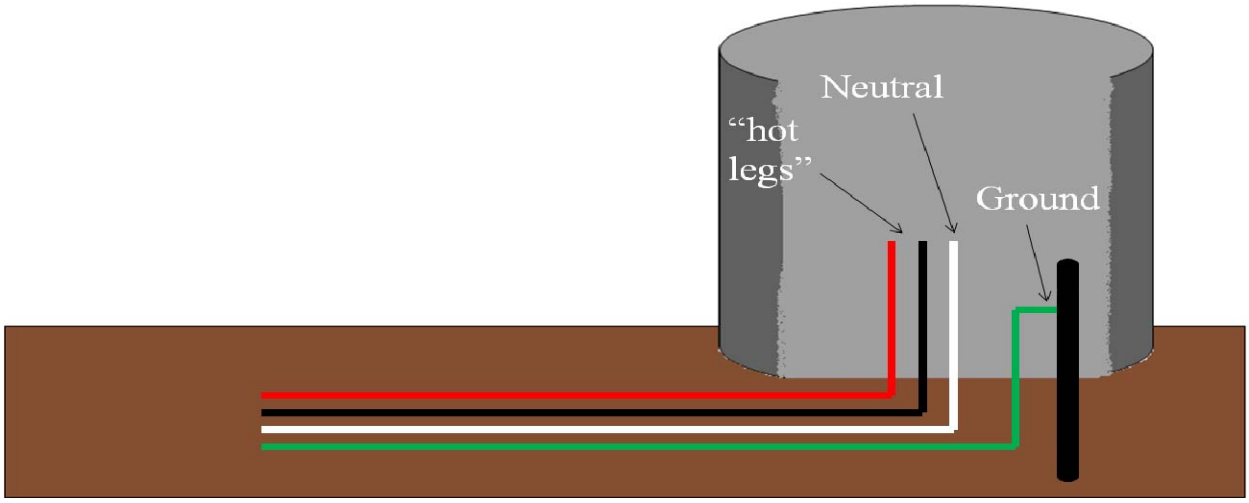

Figure 30: Cut-away view of 4 wire system in a light standard.

III. STRAY VOLTAGE REGULATION [5]

The regulation of stray voltage started with legislation related to the dairy farming industry in Wisconsin. In 1987 Wisconsin state legislators passed Wisconsin Act 399 granting the Wisconsin Public Service Commission (PSC) authority to create stray voltage rules. Funding was provided to sponsor utility research to investigate the stray voltage issues on the local dairy farms. The scientific report concluded stray voltage was present and deemed counterproductive to dairy farm operations. Based on the recommendations of the report, the Wisconsin PSC mandated that mitigative action must be taken when voltage levels of 0.5V (1mA through 500Ω test resistor) or greater are detected. This decision was overturned in 1996 when another scientific study indicated that the 0.5V limit was too conservative because the 500Ω test resistor already includes a factor of safety. Concerns among dairy farmers in Vermont also resulted in legislative action in 1994. In response to the legislation, the Department of Agriculture, Food and Markets, the Department of Public Service, and the electric utilities worked together to investigate stray voltage and corrective actions. The group determined that should stray voltage

levels over 0.5V be detected, neutral isolators be installed at the utilities expense. Similarly, Connecticut's Department of Public Utility Control (DPUC) found that stray voltage can cause physiological and behavioral changes in livestock, production losses, and financial loss and psychological stress for the farmer. The DPUC mandated that corrective action must be taken when stray voltage levels exceed 0.5V (1mA) in livestock contact areas and 1V between primary earth and neutral conductors. Minnesota's Public Utilities Commission (PUC) launched a scientific study which released a report in 1998 stating that they could find no credible scientific evidence that stray voltages cause poor health or milk production among dairy cows. As a result of the findings, the Minnesota PUC did not enact any stray voltage regulation.

Utility regulation in metropolitan areas is more recent. 15 years after the Wisconsin PSC established stray voltage regulations, the New Jersey Board of Public Utilities (BPU) investigated claims of nuisance shocking in pools and hot tubs. The NJBPU required the Jersey Central Power and Light to increase the size of the primary neutral conductors and to balance the loads of circuits to within 10% average and within 15% peak demands. They also were required to expand the ground area of substations. In 2005 the New York Public Safety Commission (PSC) orders Consolidated Edison to test man-hole covers, street lights, service boxes, and vaults and report its findings. The effort was in response to the death of Jodie Lane in 2004; a New York City woman who fell on a live man-hole cover. After review of the utility report, the PSC specified 8-600V detection devices and adopted the National Electric Safety Code. Additionally, rate based fines were issued if utilities failed to implement the requirements. The current stray voltage limits imposed by the New York State PSC require voltages over 1V to be remediated. Lastly, in 2006 the Massachusetts Department of Telecommunications and Energy (DTE) investigated reports of dog injuries and fatalities due to electrocution from man-hole covers. The

DTE imposed stray voltage regulation that limited voltages between 8-20V. Utilities are required to immediately disconnect circuits that produce stray voltages greater than 20V, while voltages between 8-20V must be remediated within 24 hours. Stray voltage less than 8V is up to the discretion of the utility whether or not they address the issue. A timeline of these legislative and regulatory actions is illustrated in Figure 31.

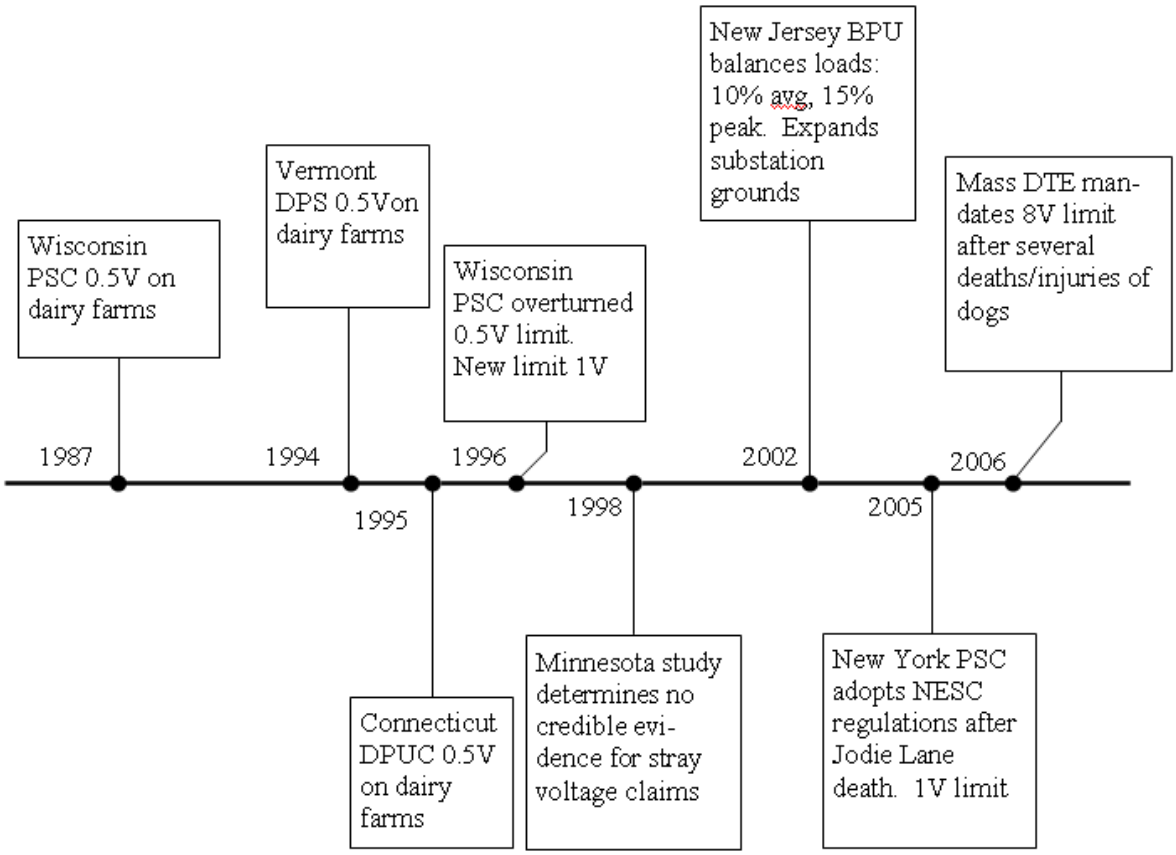

Figure 31: State regulation and utility response timeline for stray voltage.

IV. ELECTRICAL SAFETY

Electrical safety is a topic that is both studied and regulated by many organizations. The regulations may be specific to a certain occupation or they may be general regulations that are adopted nationally. Therefore, the safety limits do not always coincide because of this variability. Interestingly enough, the safety thresholds (Table 1) of various national and international regulatory bodies are considerably higher than the stray voltage limits set by several states. These thresholds represent the maximum voltage that is still considered safe, or in other words, the maximum voltage that will not result in bodily harm. These thresholds are concerned with human safety rather than human comfort.

Table 1: Other national and international electrical safety regulations [6, 7]

Regulating Body	**Thresholds**
OSHA Occupational Safety Health Administration	50Vac (shock hazard)
NESC National Electric Safety Code	50Vac
NEC (dry/wet) National Electric Code	50Vac/15Vac
ARRL Amateur Radio Relay League	35Vac
UL-60950 Underwriter Laboratories	42.4Vac dry
IEC 479-1 International Electric Code	25Vac clearly safe (1kΩ)
IEC 479-1 International Electric Code	50Vac marginally safe (shock hazard) (1kΩ)
NFPA 70E National Fire Protection Association	30VRMS (500Ω) (shock hazard)
IEEE std. 80 Institute of Electronic and Electrical Engineers	60Vac for 4 sec @ 1kΩ
USDA United States Department of Agriculture (Stray Voltage)	1Vac
NYS PSC New York State Public Safety Commission (Stray Voltage)	1Vac
Massachusetts Department of Telecommunications and Energy	8Vac
Rhode Island Public Utilities Commission**	Undefined

** At the time of this report, the state senate just passed a bill in March 2011 requiring that NG monitor and check for stray voltage and has charged the Rhode Island PUC to launch an investigation. It appears that investigation is ongoing and no limits or thresholds have been resolved.

The discrepancy in safety thresholds between many reputable safety organizations and the stray voltage limits set by state legislators only leads to an interesting conundrum: what is a safe stray voltage limit? In order to investigate this it is important to break down the problem into three parts: an acceptable current level, human body resistance, and the voltage potential across the body. Once the first two parts are known, finding the voltage potential is a matter of simple algebra.

It is universally accepted that electrical current and not voltage is what is harmful to the human body. Therefore, it is crucial that an appropriate current level be established. The body's reaction to an electrical current can be characterized as perception, startle, and fibrillation [7]. Some literature suggests that human perception to electrical current can occur at values as low as 0.1mA [8]. Underwriter Laboratories (UL) research concludes that 99% of the population will not have a startle reaction to currents less than 0.5mA [7]. This value has an inherent safety factor built in and the author suggests that this corresponds to a conservative voltage level of 15V [7]. That same study concluded that 2.2mA was borderline hazardous [7]. Fibrillation is the most concerning human reaction to excessive electrical currents. Fibrillation can occur with approximately 67mA for adults and 30mA for children. It is important to note that no documented deaths caused from electrical fibrillation have occurred with voltages less than 50V [7].

The electrical impedance of the human body is very difficult to quantify due to many variables. The contact mode is important to consider: hand to hand, hand to foot, foot to foot, etc. The wetness or dryness of the contact surfaces also comes into consideration. Commonly accepted impedance values range from a conservative 300 ohm value to 2000 ohms.

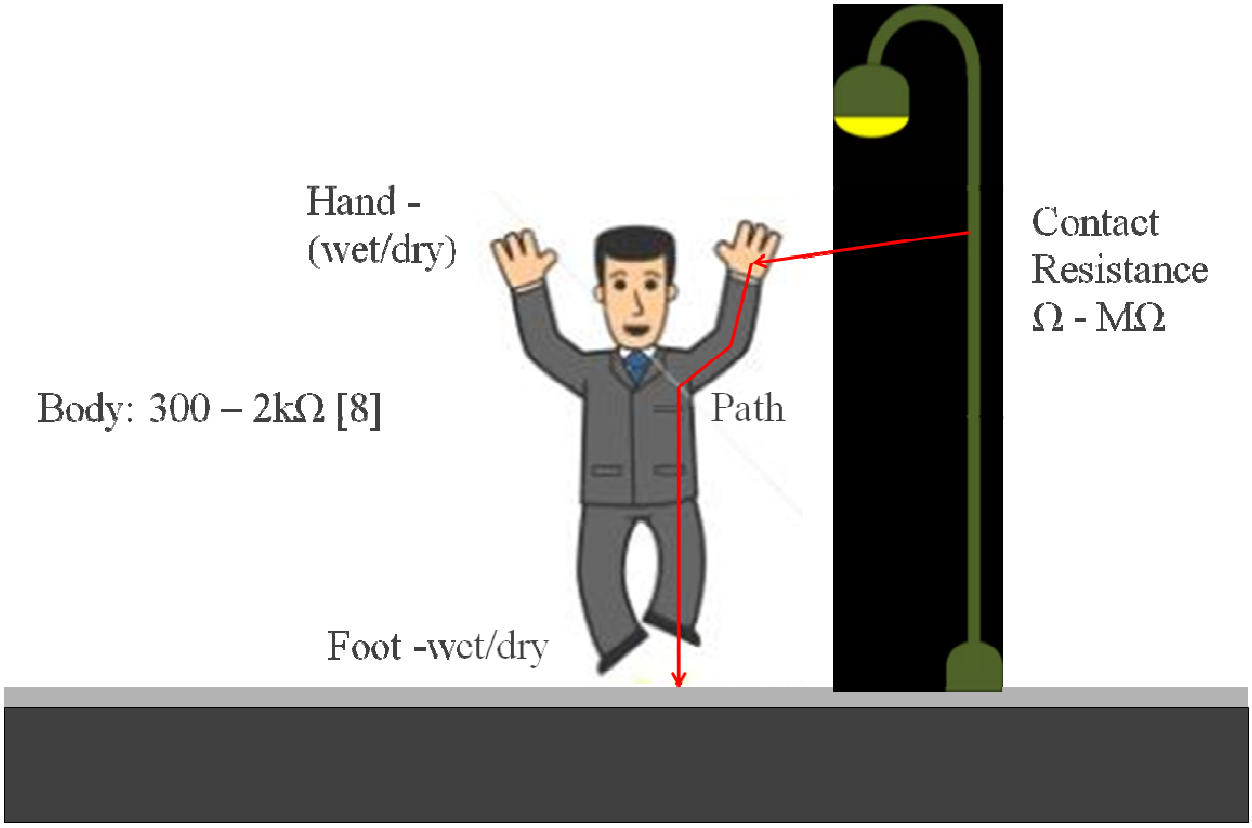

Figure 32: Impedance contact values for a human-street light interaction scenario.

Consider the diagram in Figure 32 which shows the contact resistances of each component along the path of conduction. The contact resistance of the light standard itself could range from ohms to mega-ohms. The standard could have a layer of paint, corrosion, or other foreign material buildup that acts to impede the flow of electricity. Conversely, the standard could have areas where the paint or other coating has been scratched or chipped off which would result in a very low contact impedance. The hand brings into play another set of variables. What are the conditions of the skin: hard, dry and callused, or soft and moist? In the situation shown in Figure 32 we are concerned with a hand to foot contact path. The body impedance, as previously mentioned, can assumed to be anywhere between 300 and 2000 ohms. The electricity

must then find a path to ground through the foot. The foot to ground interface also has a range of values which can span from hundreds of ohms to mega-ohms. The lowest impedance most likely would be achieved with an individual standing barefoot on a metal object such as a drain grate or manhole cover which is submerged in water. Higher impedances values would occur with a dry rubber soled shoe standing on asphalt or concrete. These equivalent impedances are shown in circuit form in Figure 33.

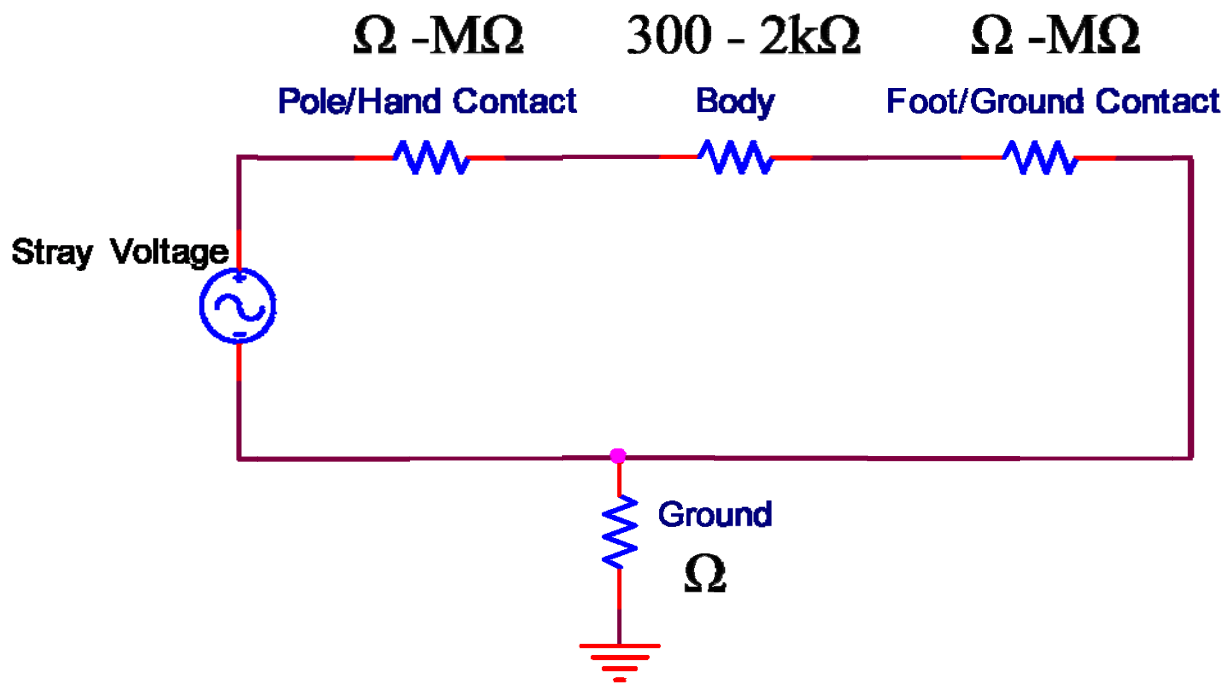

Figure 33: Circuit diagram illustrating different components and ranges of contact impedances for the individual touching a light standard in Figure 32.

With the circuit diagram in Figure 33, it is now possible to calculate the acceptable stray voltage value if the three impedance values are known. If low conservative values are assumed for the pole/hand contact impedance and the foot/ground contact impedance then the body impedance value will dominate. This would result in a stray voltage range of 0.6 - 4.4V for the 2.2mA

reaction hazard threshold stated earlier. It is important to note that the 2.2mA was considered borderline hazardous because the reaction from that current could cause someone to injury themselves through other means (falling off a ladder, etc.) rather than the current itself being hazardous. For situations related to touching a street light, higher contact impedances are a likely scenario. While it is feasible that hand-light standard impedances can be low, it is likely that the foot-ground interface will be substantially higher. This could put the overall effective impedance at a value of a few thousand ohms or more. For a value of 4000 ohms, the stray voltage limit would be 8.8V.

Clearly, defining a stray voltage limit is a difficult task because one must assume an equivalent human body impedance for a vast array of situations. Perhaps what could be more appropriate would be to define a lower limit for higher risk areas such as pools and hot tubs. An individual submerged in water reaching out to grab a metal ladder or pole would likely result in what is termed a "nuisance shock" with stray voltage values as little as a few volts. However, an individual touching a street lamp is not completely submerged in water like in the case of the swimmer, and is most likely fully clothed. It would therefore be appropriate to have more relaxed stray voltage limits in these type of settings.

It is interesting to see the large discrepancies in electrical safety thresholds defined in Table 1 compared to the limits established by state legislators in section III, while the safety values derived in this section fall somewhere between. One possible explanation for the discrepancy between the stray voltage limits and the electrical safety thresholds is that much of the of the stray voltage research was concerned with how electrical currents affected the behavior, health and milk production of cattle. It is quite evident that the threshold to disrupt the normal behavior of the cows is much different from the threshold that will cause injury to the

cow. The claims from dairy farmers was never based on the notion that cows were being injured, but rather that the cows were behaving erratically in milking parlors and that overall milk production had decreased. When talking about stray voltage in metropolitan areas and specifically with street lights and other metal structures, it is important to focus on the safety of the public rather than their comfort. It is evident that many of the regulatory bodies were concerned with safety rather than comfort which is why their electrical safety thresholds are considerable higher.

V. RECOMMENDATIONS

Based on the review of the stray voltage phenomenon and its history, we have the following recommendations.

Scanning - The remote scanning should continue to help "sniff" out issues within the street light circuit. In 2009, the Buffalo metropolitan area overseen by National Grid had 861 hits that were over 4.5V [9]. Some of these hits could be dangerous and lethal contact voltage and must be discovered and corrected. The scanning provides a quick way to detect these dangerous voltages as well as elevated stray voltage.

Upgrade Investment - Generally speaking, the electrical utility network is very old. The street light circuits in older neighborhoods are several decades old and the buried underground cable is approaching end of life. It would be beneficial to replace the old 3-wire system with the 4-wire system discussed previously during upgrades. The insulated wire that is currently being used in new installs is far superior to the older coaxial style with lead neutral and should continue to be used. Care should be taken when installing new cabling such that it is isolated from the earth as

much as possible when buried and should not be routed in areas that are high risk for being damaged from construction or other means. When laying out new or upgrading existing lighting networks, the circuits should be balanced (ie number of lights on each phase are as close as possible).

Record Keeping - Superior record keeping will help aid with future troubleshooting and will save money in the long run. Documentation should include not only the magnitude of the stray voltage but the position of the light standard within the circuit. The corrective solution should also be noted as well. For example, simulation case 3 and 4 in section II illustrates the importance of noting the position where the stray voltage occurred. In simulation 3 a corroded neutral was placed at the beginning of the light circuit (nearest the transformer) which produced an elevated stray voltage on all seven light standards located after the corroded cable. Conversely, in simulation case 4 the corroded neutral was placed between light standards 7 and 8 which resulted in a neutral to earth elevated voltage only on light standard 8 while the rest of the light standard voltages remained similar to the baseline case. Statistics and analysis similar to this can be a very powerful cost saving tool. When crew members identify these types of relationships they can very quickly identify, locate, and correct stray voltage issues which will result in smaller work crews, less overtime, and an overall cost reduction.

Stray Voltage Thresholds Re-defined - There seems to be a conflict of numbers between many electrical safety authorities and many state legislators. Much of this is due to several safety factors implemented in the stray voltage limits as well as these limits being translated from studies done on dairy farms. The focus of the thresholds should relate to human safety rather than comfort. Massachusetts DTE stray voltage limits seem very appropriate. Any stray voltage limit detected that is under 8V is up to the discretion of the utility to correct. While it would

behoove the utility to be prudent and correct whatever is causing the stray voltage before it gets to a possibly dangerous level, this voltage level is harmless as corroborated by the standards shown in Table 1. The Massachusetts DTE requires voltages between 8 and 20V to be corrected within 24 hours and anything over 20V must be disconnected immediately. The 8V threshold fits more appropriately with much of the current research that defines stray voltage as "…usually less than 10V" and "…considered harmless" [3]. The utilities should push to have the current 1V limit raised to a more realistic and appropriate, and yet safe, level of 8V.

VI. SUMMARY

The Energy Systems Institute at the University at Buffalo has investigated the stray voltage issues occurring in many of the street light circuits in the Buffalo metropolitan area. The history of stray voltage occurrences stemming from the dairy industry has been reviewed as well as the legislative history. Many northeast states in the US have adopted stray voltage limits which were reviewed and presented in this work. A full analysis of what factors cause stray voltage was carried out and it was determined that various forms of imbalances are the dominant factor. A discussion on electrical safety provided insight into the difficulty of establishing stray voltage limits. It was determined that many factors of safety are built into many of the stray voltage limits, including New York State, and the limits may be grossly conservative. Several recommendations have been suggested to the utility that can help them detect, correct, and mitigate stray voltage now and in the future.

VII. REFERENCES

[1] A. Lefcourt, "Behavioral Responses of Dairy Cows Subjected to Controlled Voltages," *Journal of Dairy Science,* vol. 65, pp. 672-674, 1982.

[2] D. Dorr, W. Howe, P. Lim, et al., "Understanding nuisance shocking from an electric power utility perspective," in *Power Engineering Conference, 2007. IPEC 2007. International*, 2007, pp. 505-509.

[3] IEEE, "IEEE Working Group on Voltages at Publicly and Privately Accessible Locations", [Online]. Available: http://grouper.ieee.org/groups/td/dist/stray/. [Accessed: January 10th, 2011].

[4] J. G. Biddle, "Getting down to earth...", 3rd ed, B. Co., Ed., 1978.

[5] C. DeNardo, "Stray Voltage: Legislative and Regulatory Activity," IEEE Winter Technical Committee Meeting, 2006.

[6] J. Burke, "The Confusion Surrounding Stray Voltage," in *Rural Electric Power Conference, 2007 IEEE*, 2007, pp. C1-C1-5.

[7] D. Dorr, "Determining voltage levels of concern for human and animal response to AC current," in *Power & Energy Society General Meeting, 2009. PES '09. IEEE*, 2009, pp. 1-6.

[8] J. P. Reilly, *Applied Bioelectricity: From Electrical Stimulation to Electropathology*. New York: Springer-Verlag, 1998.

[9] W. Cole, "National Grid - Stray Voltage in Buffalo, NY," Buffalo, NY, 2010.

Appendix 9

NG-EOP G016
Equipment Elevated Voltage Testing

INTRODUCTION

The purpose of this procedure is to outline the requirements for the annual equipment elevated voltage testing on National Grid Facilities in New York as required by the New York Public Service Commission's "Electric Safety Standards" issued on January 5, 2005, the New York Public Service Commission's "Order Adopting Changes to Electric Safety Standards issued and effective on December 15, 2008 and the New York Public Service Commission's "Order Requiring Additional Mobile Stray Voltage Testing" issued and effective on July 21, 2010. Additionally the Massachusetts Department of Telecommunications and Energy provided a series of recommendations on December 9, 2005, that have been included in this procedure.

This procedure also outlines corporate requirements for equipment elevated voltage testing in New Hampshire and Rhode Island. The variance in requirements between New York, Massachusetts, New Hampshire, and Rhode Island is based on sound utility practice versus regulatory requirements.

PURPOSE

This procedure applies to all personnel involved with or responsible for the testing of facilities designated by this EOP for equipment elevated voltage.

ACCOUNTABILITY

1. Distribution Engineering Services
   A. Update program as necessary.
   B. Provide field support and training upon request.
   C. Act as liaison with existing database vendor when required.

2. Inspections
   A. Ensure the equipment elevated voltage program as outlined in this EOP is implemented properly and timely.
   B. Ensure that the program as outlined in the EOP is completed each year.
   C. Provide qualified personnel to complete equipment elevated voltage testing.
   D. Ensure all equipment elevated voltage testers have been trained.

3. C&MS Management
   A. When requested by Field Operations/Distribution Network Strategy obtain, schedule and manage contractors to perform equipment elevated voltage testing.
   B. Ensure all equipment elevated voltage testers have been trained.
   C. Manage contractual terms and conditions including all change orders and resource requirements.

D. Establish a process for the delivery of work, collection of data, invoice verification and payment, and reporting to local management and Distribution Network Strategy.

E. Manage any established support processes such as back office support or data entry clerks.

4. Equipment elevated Voltage Inspector

A. Demonstrate the ability and proficiency to perform equipment elevated voltage testing per this EOP.

B. Demonstrate the ability to become proficient in the use of the appropriate database.

C. Possess the ability to do walking patrols, collect information, edit data, and guard unsafe facilities.

D. Attend equipment elevated voltage training program.

5. T&D Technical Training

A. Provide training upon request.

6. Distribution Network Strategy

A. Provide input into program revisions.

B. Ensure the equipment elevated voltage program as outlined in this EOP is implemented properly and timely.

C. Ensure the program as outlined in the EOP is completed each year.

D. Provide qualified personnel to complete equipment elevated voltage testing.

E. Ensure all equipment elevated voltage testers have been trained.

F. Provide program management.

7. Process and Systems

A. Provide and support database.

REFERENCES

NYPSC Order 04-M-0159
NYPSC Order Adopting Changes to Electric Safety Standards
NYPSC Order Requiring Additional Mobile Stray Voltage Testing
Applicable National Grid Safety Rules & Procedures
Testing Equipment Operation Instructions

DEFINITIONS

Stray Voltage: As defined by NYPSC the term “Stray Voltage” means voltage conditions on electric facilities that should not ordinarily exist.

Stray Voltage Testing: The process of checking an electric facility for stray voltage using a device capable of reliably detecting and audibly and/or visually signaling voltages in the range of 6 to 600 volts.

Proximity Detection Unit: A low voltage hand held detector used to test exposed metallic surfaces and conductors for the presence of low voltage from 6V to 600V.

Equipment Elevated Voltage Inspector: The individual performing the equipment elevated voltage inspection.

Handheld Computer: An electronic Data recording device that is used in the field to create a record of conditions found.

Equipment Elevated Voltage: An A.C. rms voltage difference between utility equipment and the earth, or to nearby grounded facilities that exceeds the lowest perceptible voltage levels for humans.

Finding: Any confirmed voltage reading on an electric facility or streetlight greater than or equal to 1V measured using a volt meter and a 500 ohm shunt resistor.

Mitigation: Corrective actions performed by the utility to address the stray voltage finding.

DOCUMENT CONTENTS

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1.0 FACILITIES WHERE EQUIPMENT ELEVATE VOLTAGE TESTING/DOCUMENTATION IS REQUIRED – NEW YORK

1.1 Street Lights and Municipally Owned Facilities

1.1.1 Company owned metallic street lighting standards are required to be tested for equipment elevated voltage annually. This test is to be performed while the light is operating.

1.1.2 Municipally owned street light systems that National Grid directly provides energy to must be tested for equipment elevated voltage annually. National Grid will complete this testing unless assurances of the completion of required testing and transfer of such test data are made by the appropriate municipality. This test is to be performed while the light is operating.

1.1.3 Municipal owned metallic traffic signal standards and accessible devices are to be tested annually for equipment elevated voltage by National Grid.

1.1.4 All street lights identified on public thoroughfares regardless of ownership are to be tested annually.

1.1.5 All street lights under a maintenance contract are to be tested annually. Exceptions not requiring equipment elevated voltage testing: private lighting, park associations, parking lots, fiberglass (or other non-conductive) street light standards, and locations where street light standards are not publicly accessible, such as facilities located in the center of highways that cannot be accessed without stopping traffic or creating potentially hazardous situations for the worker and/or public.

1.2 National Grid Substation Fences

1.2.1 Metallic fencing surrounding substations with National Grid Facilities shall be tested for equipment elevated voltage annually. This fencing can be customer owned for customer stations, if a National Grid facility is part of the station.

1.3 Overhead Distribution Facilities

1.3.1 Towers and/or metallic poles with distribution facilities shall be tested annually for equipment elevated voltage.

1.3.2 The following equipment on wood distribution poles requires annual equipment elevated voltage testing:

1. Metallic riser guard or conduit (company or non-company).
2. Uncovered or uninsulated down ground (company or non-company).
3. Down guy (company or non-company).
4. Any other publicly accessible conductive piece of equipment (company or non-company) on the pole within reach from the ground.

1.3.3 Exceptions: Customer meters and customer meter poles are excluded.

1.4 Overhead Transmission Facilities

1.4.1 Towers and/or metallic poles with transmission facilities shall be tested annually for equipment elevated voltage.

1.4.2 The following equipment on wood transmission poles or structures require annual equipment elevated voltage testing:

a. Metallic riser guard or conduit (company or non-company).

b. Uncovered or uninsulated down ground (company or non-company).

c. Down guy (company or non-company).

d. Any other publicly accessible conductive piece of equipment (company or non-company) on the pole or structure within reach from the ground.

1.5 Underground Facilities

1.5.1 Annual equipment elevated voltage testing is required on all of the following equipment where accessible to the public.

1.5.2 All metallic manhole covers, vault covers and grates, junction box covers, handhole covers, pad mount transformers, and switchgear.

1.5.3 Starting in 2010 and continuing thereafter, unless changed by subsequent order of the NY Public Service Commission, two mobile stray voltage surveys shall be conducted annually in Buffalo and one mobile stray voltage survey is required to be conducted annually in Albany and Niagara Falls.

1.5.4 Exceptions: Non-metallic concrete or fiberglass pads or handholes are not required to be tested.

1.6 Daily Job Site Test Requirements

1.6.1 Each job site where National Grid personnel or its contractors complete a work assignment shall be tested for equipment elevated voltage at the end of the work day or the completion of the assignment. **This testing requirement is considered good utility practice and does not require specific documentation.**

1.6.2 Exceptions:

a. Substation fencing will not require equipment elevated voltage testing unless scheduled as part of the inspection program or if work was done on the fencing.

b. In a storm situation, where mutual aid is required, testing by other than National Grid personnel will not be required.

1.7 Exemptions

1.7.1 A completely fenced in area where access is denied to the general public and where access is only achieved by climbing a fence. Good judgment is required by the tester in these scenarios.

2.0 FACILITIES WHERE EQUIPMENT ELEVATED VOLTAGE TESTING/DOCUMENTATION IS REQUIRED – NEW HAMSHIRE AND RHODE ISLAND

2.1 Company Owned Street Lights

2.1.1 Testing will be performed during each outage investigation notification and the data will be recorded for each instance.

2.2 Overhead Distribution Facilities

2.2.1 Wood distribution poles require testing to be completed on metallic risers in conjunction with the distribution patrol program covered by NG-USA EOP D004.

2.2.2 Documentation is only required on metallic risers found to be at an elevated voltage requiring repair. Testing data is not required for a facility that is found to be operating as designed.

2.3 Underground Facilities

2.3.1 Testing for equipment elevated voltage shall be done while completing scheduled inspections of underground equipment covered by NG-USA EOP UG006, Underground Inspection and Maintenance. The following items are to be tested on a five year cycle, padmount transformers, switchgears, and metallic handhole covers.

2.3.2 Testing for equipment elevated voltage shall be completed on underground facilities while completing working inspections covered by NG-USA EOP UG006. The metallic items to be tested are manholes covers, vault covers, handhole covers, splice box covers, junction box covers, padmount transformers, switchgear, and submersible equipment covers.

2.4 Daily Job Site Test Requirements

2.4.1 Each job site where National Grid personnel or its contractors complete a work assignment shall be tested for equipment elevated voltage at the end of the work day or the completion of the assignment. **This testing requirement is considered good utility practice and does not require specific documentation**.

a. In a storm situation, where mutual aid is required, testing by other than National Grid personnel will not be required.

2.5 Exemptions

2.5.1 A completely fenced in area where access is denied to the general public and where access is only achieved by climbing a fence. Good judgment is required by the tester in these scenarios.

3.0 FACILITIES WHERE EQUIPMENT ELEVATED VOLTAGE TESTING/DOCUMENTATION IS REQUIRED – MASSACHUSETTS

3.1 Company Owned Street Lights

3.1.1 Company owned metallic street lighting standards are required to be tested for equipment elevated voltage on a five year cycle.

3.1.2 Exceptions: Testing shall not be completed at locations where street light standards are not publicly accessible, such as facilities located in the center of highways that cannot be accessed without stopping traffic or creating potentially hazardous situations for the worker and/or public.

3.2 Overhead Distribution Facilities

3.2.1 Wood distribution poles require testing to be completed as noted below in conjunction with the distribution patrol program covered by NG-USA EOP D004.

3.2.2 The following equipment on wood distribution poles requires annual equipment elevated voltage testing:

a. Metallic riser guard or conduit (company or non-company).

b. Uncovered or uninsulated down ground (company or non-company).

c. Down guy (company or non-company).

d. Any other publicly accessible conductive piece of equipment (company or non-company) on the pole within reach from the ground.

3.3 Underground Facilities

3.3.1 Equipment elevated voltage testing is required on all of the following equipment where accessible to the public on a five year cycle.

a. All metallic manhole covers, vault covers and grates, junction box covers, handhole covers, pad mount transformers, secondary pedestals, and switchgear.

Exceptions: Non-metallic concrete or fiberglass pads or handholes are not required to be tested.

3.4 Daily Job Site Test Requirements

3.4.1 Each job site where National Grid personnel or its contractors complete a work assignment shall be tested for equipment elevated voltage at the end of the work day or the completion of the assignment. **This testing requirement is considered good utility practice and does not require specific documentation**.

a. In a storm situation, where mutual aid is required, testing by other than National Grid personnel will not be required.

3.5 Exemptions

3.5.1 A completely fenced in area where access is denied to the general public and where access is only achieved by climbing a fence. Good judgment is required by the tester in these scenarios.

4.0 TEST EQUIPMENT

4.1 A hand held device (proximity detection unit) that is capable of detecting voltage from 6 volts to 600 volts.

4.2 A portable AC digital high impedance volt meter must have the ability to take readings with and without an input load impedance of 500 ohms.

4.3 The handheld devices utilized must be certified by an independent test laboratory as being able to reliably detect voltages of 6 – 600 volts. The following units have been certified:

4.3.1 HD Electric model LV-S-5 (5-600 volts).

Fluke 85
Fluke 87
Fluke 170 series or equivalent
Fluke 175
Fluke 177
Fluke 179
Fluke 187
Fluke 189

5.0 TEST PROCEDURE

5.1 Job Briefing

5.1.1 At minimum, the following information must be communicated to all personnel at the beginning of each shift for equipment elevated voltage testing:

a. Structures are never to be touched with a bare hand while performing the tests, only the voltage detector or meter probe is to be used to make contact with the facilities.

b. Appropriate PPE must be worn.

c. Each individual needs to be aware of his/her surroundings at all times.

d. Make sure to observe all traffic before entering a street, either at intersections or any other point.

e. Traffic safety vest (DOT Compliant Class II) is to be worn at all times when exposed to traffic. Be aware that when bending down, the visibility benefits of the traffic safety vest are diminished.

f. Obey all traffic control devices.

g. When working in the street, face oncoming traffic whenever possible.

5.2 Measurements for voltages will be performed in accordance with the following:

5.2.1 Initial measurements for the presence of voltage shall be made using a certified proximity detection unit as noted in the testing equipment certified equipment list in Section 4.0, 4.3.

a. To verify the proper operation of the proximity detector, follow operating instructions for the particular certified unit being utilized, this is to be done daily.

b. After verification that the detection unit is working, approach the area/equipment to be tested. The proximity detector will illuminate prior to touching the area/equipment being tested if voltage is present. If the proximity detector does not illuminate in close proximity to the area/equipment touch the area/equipment to be tested with the probe of the unit.

5.2.2 If this test detects voltage, repeat the test with the portable AC voltmeter (The 500 ohm. Resistor is NOT used in this initial test):

a. Measurements with a portable AC voltmeter shall be taken on clean bare metallic surface (structure, ground wire, etc.)

b. When using a portable AC voltmeter, connection shall be made to suitable neutral or ground source with the common (black) lead.

1. In locations where the neutral or ground point is at a distance in excess of the voltmeter lead length, the connection to the neutral/ground shall be made with up to 25’ of # 16 stranded copper lead wire (covered), the other end of which shall be securely connected to the negative (black) probe of the meter. When using such “extension leads” appropriate care shall be taken in the placement of such leads so as to not create a physical hazard to workers, pedestrian or vehicular traffic.

2. In locations where a system ground is not available, or the existing ground registered voltage upon the proximity test, a metal rod shall be firmly embedded into the earth to a depth of no less than 6” to create a ground reference point for the measurement to be taken. An alternate method is available for obtaining a ground reference point utilizing an aluminum plate in lieu of driving a ground rod. The reference point should be as close as practicable to the facility being tested to simulate an equipment elevated voltage situation (3’ to 4’.) On occasion longer leads may be necessary to find undisturbed earth (up to 25’.)

c. The “live” meter probe lead shall then be placed into contact with the structure under inspection to determine the voltage.

1. Voltages readings greater than 30 volts shall be recorded in the database for the site.

2. For voltage readings less than 30 volts, install a 500 ohm input load impedance resistor on the volt meter. Take another voltage measurement and record this voltage in the database for the site.

6.0 CORRECTIVE ACTION REQUIREMENTS FOR ELEVATED VOLTAGE FINDINGS

6.1

6.1.1 New York

If an equipment elevated voltage condition is found and verified by the Test Procedure in Section 5.0, the site is to be guarded until made safe by Company personnel or if municipally owned, made safe by the owner or company. Guarded for the purpose of this EOP is defined as guarded by a person or a protective barrier that prevents public contact if the equipment elevated voltage found is greater than 1 volt. **If the voltage measures less than 1 volt and is found to be consistent with system operation design (no visual evidence of a problem upon review) no further action is required.** If the voltage measures greater than or equal to 1 volts and less than 4.5 volts it can either be guarded in person or by a protective barrier that prevents public contact, contact your supervisor for required action. It is expected that sound judgment shall be utilized in this application. If the voltage measurement is greater than or equal to 4.5 volts it must be guarded by an equipment elevated voltage inspector or a Company employee that has been trained to stand by on energized facilities, and immediate response is required using the notification in Section 6.3 below.

6.1.2 New England

If an equipment elevated voltage condition is found and verified by the Test Procedure in Section 5.0, the site is to be guarded until made safe by Company personnel or if municipally owned, made safe by the owner or company. Guarded for the purpose of this EOP is defined as guarded by a person or a protective barrier that prevents public contact if the equipment elevated voltage found is greater than 4.5 volts. **If the voltage measures less than 4.5 volts and is found to be consistent with system operation design (no visual evidence of a problem upon review) no further action is required.** If the voltage measures greater than 4.5 volts and less than 8 volts it can either be guarded in person or by a protective barrier that prevents public contact, contact your supervisor for required action. It is expected that sound judgment shall be utilized in this application. If the voltage measurement is greater than 8 volts it must be guarded by an equipment elevated voltage inspector or a Company employee that has been trained to stand by on energized facilities; and immediate response is required using the notification in section 6.3 below

6.2 In the event of an elevated voltage finding on an electric facility or streetlight during the stray voltage Test Procedure, all publicly accessible structures and sidewalks within a minimum 30 foot radius of the electric facility or streetlight must be tested for stray voltage for New York.

6.3 The following notification process for personnel to respond shall be utilized.

6.3.1 Notification by location:

a. New York: contact Systems Operations Dispatch 1-877-716-4996

b. Bay State West and North & Granite: Westboro Control Center 508-389-9032.

c. Bay State South and Ocean State: Lincoln Control Center 401-335-6075.

6.3.2 Inform the operator that this is an equipment elevated voltage call, giving inspector name, company (if not National Grid), unique ID, address where problem is identified, facility number, circuit number , ownership, type of equipment, voltage found and whether they are physically guarding or leaving the site after flagging and installing a protective barrier. National Grid personnel or designee will be assigned to respond.

6.4 Temporary repairs may be used to correct the equipment elevated voltage thereby removing the need to guard the site.

6.5 Except as noted in Section 6, 6.6, permanent repairs to the equipment shall be made within 45 days of the occurrence.

6.6 If permanent repairs can not be made within 45 days due to extraordinary circumstances, the company shall periodically perform site visits to monitor the condition of the temporary repair. For New York, all exceptions must be identified and justified in the annual reporting of the program to the NYPSC.

6.7 The Stray Voltage Tester/Equipment elevated Voltage Inspector may detect a minimal voltage level that is attributable to the design of the facility and not the result of an improper condition, no corrective action is required in this instance.

6.8 The individuals conducting the equipment elevated voltage tests on street light standards shall have a supply of “Angel guards” available for installation if the cover is missing or wires are found to be exposed to the public at the time of testing. Angel guards shall only be installed after the testing of the street light standard is complete and 1) there is no indication of equipment elevated voltage above 1 volt, or 2) repairs have been completed to correct the equipment elevated voltage.

6.9 The equipment elevated voltage inspector shall report any potentially hazardous conditions found on National Grid facilities seen visually during the survey process.

6.10 Customer Owned Equipment

6.10.1 Where the Company finds equipment elevated voltage above 1 volt and identifies its source as customer-owned equipment, the Company shall guard the site and notify the customer or a responsible person, as appropriate, that a potentially hazardous situation exists. The Company shall advise the customer or responsible person that the cause of the equipment elevated voltage must be immediately remedied.

6.10.2 Company personnel are encouraged to work with the customer to determine and rectify the problem. If the customer agrees to accept the Company's assistance, the Company may charge a reasonable cost for this effort.

a. The Company may temporarily remove a customer's meter or take such other actions as are appropriate and necessary to protect the public.

7.0 DATABASE REQUIREMENTS

7.1 The database in use shall be easily searchable for information and reporting.

7.2 Information fields required to be completed for facilities:

Survey Date
Region
District
Contractor
GIS ID/Asset # (Unique ID)
Facility Type
Owner
Feeder/Circuit
Line #
Tax District
Pole/Structure/Equipment ID
Street Name
Inspectors Name
GPS Taken
Pre-load Match
Equipment elevated Voltage Test Required
Voltage Found Y/N
Voltage Measurement
Type of Equipment (See Appendix A)
Immediate Action Taken
Person Notified
Permanent Repair Date
Type of Repair
Person Responsible for repair (Employee ID)

8.0 NEW YORK ANNUAL REPORTING AND CERTIFICATION REQUIREMENTS

8.1 Each Regional program supervisor shall provide certification to the program manager that the Region they supervise has complied with the equipment elevated voltage testing and inspection program as ordered by the PSC.

8.2 The program manager shall provide certification to the Vice President Distribution Network Strategy and the Senior Vice President of Customer Operations & Maintenance that the organization has complied with the equipment elevated voltage testing and inspection program as ordered by the PSC.

8.3 Written certification of the completion and results of every equipment elevated voltage test and inspection shall be completed, as well as a certification that all unsafe conditions identified have been remediated by appropriate company personnel.

8.4 The President or officer with direct responsibility for overseeing the equipment elevated voltage testing and inspection shall provide an annual certification to the NYPSC that the Company has tested all of its publicly accessible conductive surface electric facilities and all street lights, as well as completed all required inspections.

8.5 The President or officer with direct responsibility for overseeing facility inspections shall provide an annual certification to the Commission that the utility is in compliance with its inspection program and has inspected the requisite number of electric facilities. Additionally, at the end of the five-year inspection cycle, the officer shall certify that all of the utility's electric facilities have been inspected at least once.

8.6 The annual reporting and certification is required by February 15 of each year. In addition to certifications, it shall address the following:

8.6.1 Details the results of stray voltage test results and inspections conducted over the 12-month period ending December 31 of the prior calendar year. (A separate report will be required for inspections from November 1 – December 31, 2008 to account for transition to calendar year reporting.)

8.6.2 Addresses the performance mechanism contained in Section 10 of the PSC Order Adopting Changes to Electric Safety Standard effective December 15, 2008 (December 15, 2008 Order).

8.6.3 Contain certification describe in 8.3, 8.4 and 8.5 of this section.

8.6.4 Contain a breakdown of the voltage findings in a tabular format as detailed in Attachment 1 of the December 15, 2008 Order; for all findings that result in a reading of 1 V or more after completion of mitigation efforts, a detail report of company efforts shall be provided.

8.6.5 Contain a breakdown of the shock reports received from the public as detailed in Attachment 2 of the December 15, 2008 Order.

8.6.6 Discussion of the analysis undertaken on the causes of the stray voltage within the Company's electric system, the conclusions drawn there from, the preventative and remedial measures identified, and the Company's plan to implement those measures.

8.6.7 Description of the priority levels used to gauge the severity of a deficiency, including repair timeframes, and details the requirements for training personnel to properly identify and categorize the deficiencies.

8.6.8 Contain a breakdown of facilities to be inspected, unique inspection conducted per year, and the cumulative number of unique inspections conducted to meet the five year requirement.

8.6.9 Contain a breakdown of the deficiencies found, permanent repair actions taken by year, whether a repair was completed within the required timeframe, and the

number of deficiencies awaiting repair. This information should be provided on a yearly basis by priority level and by equipment groupings as detailed in Attachment 3 of the December 15, 2008 Order.

8.6.10 Contain a review and analysis of the inspection results. Identifying areas of concern along with remedial actions or future plans to alleviate inadequacies in current program assets.

8.6.11 Description of the quality assurance program along with the results from quality assurance activities conducted during the year.

8.6.12 Any additional information that is pertinent to the issues addressed by the safety standards should also be included.

8.7 The Company shall file reports on their mobile stray voltage testing with the Secretary of the New York PSC within 45 days after completion of the mobile testing or February 15, 2011, whichever is earliest, and in each subsequent year. The filing shall include the historic results and costs associated with the manual test program in each area listed in Section 1.5 of this procedure.

8.8 The Company is required by the December 15, 2008 Order to have independence in the quality assurance program required by the order. The management and personnel performing the quality assurance activities shall be separate from those performing the required stray voltage testing and inspection activities.

8.9 The Company shall maintain its written certification and other documentary proof of its testing at its' Albany, Buffalo, and Syracuse office facilities. These documents shall be made available to the public for review upon request.

9.0 MASSACHUSETTS REPORTING REQUIREMENTS

9.1 National Grid shall submit an annual report that includes the following:

9.1.1 Annual reports that list inspection and testing data, including number of inspections conducted by equipment type.

9.1.2 Number of equipment elevated voltage events detected by inspection personnel versus call-ins or notification by third parties.

9.1.3 Variance reports on current year inspection targets.

9.1.4 Equipment elevated voltage events detected on equipment that is not included in equipment elevated voltage equipment inspection schedules (which will enable the DTE to determine if the company is inspecting and testing the correct equipment).

9.1.5 Number of exceptional or non-routine events that required reporting to OSHA or other government organizations due to injuries or other substantive impacts.

10.0 TYPE OF EQUIPMENT - APPENDIX A

TYPE	CODE	EQUIPMENT DESCRIPTION
Distribution	910	Pole
	911	Regulator
	912	Sectionalizer
	913	Recloser
	914	Ground
	915	Guy
	916	Riser
	917	Switch Handle Mechanical Operated
	929	Distribution – Other (use comments)
Transmission	930	Pole
	931	Tower
	932	Guy
	933	Ground
	934	Riser
	935	Switch Hand Mechanical Operator
	949	Transmission – Other (use comments)
Underground	950	Handhole
	951	Manhole
	952	Switchgear
	953	Transformer
	954	Vault – Cover/Door
	969	Underground – Other (use comments)
Street Light	970	Handhole
	971	Standard
	979	Street light – Other (use comments)
Customer Street Light/Other	980	Handhole
	981	Standard
	989	Customer SL/Other – Other (use comments)
Traffic Control	990	Handhole
	991	Standard
	992	Control Box
	993	Pedestrian Crossing Pole
	999	Traffic control – Other (use comments)

11.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	04/01/11	This document supersedes document dated 08/17/09.

Appendix 10

NG-EOP D004
Distribution Line Patrol and Maintenance

INTRODUCTION

The purpose of this procedure is to outline the requirements for the patrol and maintenance activities associated with National Grid Distribution feeders. The Distribution Maintenance Program was designed to provide for a patrol and subsequent maintenance of each distribution feeder once every five (5) years in NY and once every six (6) years in NE. The patrols are conducted by a Distribution Inspector identifying all required maintenance on a *Windows*® based hand held computer. The maintenance items identified through this patrol are separated into four priority levels 1, 2, 3, and 4. The problem codes identified default to the appropriate priority level. The default priority level can be adjusted by the individual performing the inspection based on actual field conditions. These priority levels are defined as follows:

Level 1- An identified facility/component or tree condition that must be repaired/replaced within 1 week.

Level 2 - *Identified facility/component condition that must be repaired/replaced within 1 year.*

Level 3 – *Identified facility/component condition that must be repaired/replaced within 3 years.*

Level 4 – This priority category is to collect inventory information on actual field conditions to be used by Investment Strategy and Work Planning.

All Level 1 priority conditions identified in the field shall be called in by the Distribution Inspector as follows:

Notification by location:

New York: System Operations Dispatch 1-877-716-4996
NE North: Westboro Control Center 1-508-421-7879
NE South: Lincoln Control Center 1-508-421-7885

Detailed information provided to the regional notification location:

Identify yourself as a Company Distribution Inspector and your work reporting area.

Details of the Level 1 Priority Condition:

Problem found.
District, Feeder No., Line No., Tax District and Pole No.
Street address and any additional information that would assist in finding the location of the problem.
If you are standing by or have secured the location.

Notification to area Inspections Supervisor for follow-up.

PURPOSE

This procedure applies to all personnel involved with or responsible for the inspection and repair of Overhead (OH) Distribution facilities, Underground Residential Developments (URDs) and Underground Commercial Developments (UCDs).

ACCOUNTABILITY

1. Distribution Engineering Services
   A. Update EOP as necessary.
2. Customer Operations
   A. Ensure the work generated by the Distribution Maintenance Program and assigned by Asset Strategy and Investment Planning is completed in the appropriate time frame.
   B. Request assistance from CMS when necessary to complete work assigned in the appropriate time frame.
3. Contract Management Services
   A. At the request of Customer Operations obtain, schedule and manage contractors to perform inspections and required maintenance.
   B. Provide input into program revisions.
4. Distribution Inspector
   A. Demonstrate the ability to identify maintenance concerns and the aptitude to become proficient in the use of a hand held computer and desktop computer.
   B. Demonstrate the understanding and requirements of this NG-EOP D004.
   C. Possess the ability to do walking patrols, collect information on a hand held, download to a desk top computer, edit data, provide requested information/reports/work tickets to supervision, and track/close out work completed in the database system.
5. Distribution Asset Strategy
   A. Select program codes/circuits to be scheduled for maintenance repair work using data collected through Distribution Maintenance Program.
   B. Approve changes to the maintenance code table.
   C. Select circuits to be patrolled for a running five-year cycle.
   D. Provide input into program revisions.
6. Inspections
   A. Ensure circuits scheduled for patrol are completed each year.
   B. Provide qualified personnel as inspectors to provide consistent and accurate identified maintenance concerns/problems.
   C. Provide program management.
   D. Report System Maintenance progress monthly by Division.

7. Process and Systems.
   A. Provide and support database.

REFERENCES

Applicable National Grid Safety Rules and Procedures

NY PSC Order 04-M-0159

NY PSC Order Order Adopting Changes to Electric Safety Standard, December 2008

Elevated Equipment Voltage Testing NG-EOP G016

Underground Inspection NG USA EOP UG006

Massachusetts DTE Directive 12/9/05

DEFINITIONS

Patrol: A walking/vehicle assessment of National Grid distribution facilities for the purpose of determining the condition of the facility and its associated components.

Hand Held Computer: A *Windows*® based data recording device that is used in the field to create a record of conditions found.

Desktop Computer: A personal computer that is connected to the National Grid network that is used to download the Hand Held Computer and retrieve the information in the form of reports.

Distribution Inspector: An employee that has been trained to identify deficiencies or non-standard construction conditions on National Grid facilities.

TRAINING

Provide training upon request.

DOCUMENT CONTENTS

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1.0 DISTRIBUTION PATROL

1.1 Distribution Patrols are conducted by a Distribution Inspector that has been trained to identify deficiencies or non-standard construction conditions on National Grid facilities. Distribution patrols are scheduled in such a manner that each distribution feeder is examined in the field once every five (5) years in NY and once every six (6) years in NE. In NY, the patrols shall be completed by December 31 due to regulatory reporting. In NE the patrols shall be completed by March 31. The most current Distribution Patrol schedule can be found in the Distribution Maintenance Program data base (RPT 1310 Feeder Patrol Status). New Distribution Feeders added to the system will be incorporated through our Geographic Information System (GIS) system and added to the appropriate inspection cycle. If the Distribution Inspector finds unmapped facilities from the information supplied from GIS, the inspector shall add the information into the *Windows*® based hand held computer for maintenance tracking purposes. NG-USA EOP G011, Preparation and Distribution of Electric Facilities Records, identifies the correct procedure for updating GIS records, if needed.

1.2 Distribution Patrol data is recorded by the Distribution Inspector on a *Windows*® based hand held computer and downloaded to the Distribution Maintenance Program. The Distribution Inspector shall also complete maintenance code 118, stencil installed and maintenance code 220, guy wire marker, maintenance code 660, switchgear missing nomenclature, maintenance code 681, transformer missing nomenclature, and maintenance code 745, enclosure missing nomenclature if found deficient upon inspection while at the site. Maintenance Codes are shown on the Distribution Field Survey Worksheet #NG0236 (Page 7). The Distribution Field Survey Worksheet can be used by the field to record maintenance items and is used for informational purposes only. The latest distribution maintenance codes are downloaded to the Hand Held Computer each time there is a change that affects the maintenance code table contained in the Distribution Maintenance Database. Printed copies of the latest maintenance code tables may be obtained by running a report on the look up tables from the Distribution Maintenance Database.

1.3 The *Windows*® based hand held computer is to be used as the primary vehicle for recording maintenance problems in the field. There may be times where it is not practicable to use the hand held computer. In these cases, the person performing the inspection should record the information on the Distribution Field Survey Worksheet #NG0236).
http://docuweb3:8092/ngs/servlet/NgStreamer?name=NG0236+Dist+Field+Survey+Wksht+D004

Once complete, the Distribution Field Survey Worksheet information must be input into the Distribution Maintenance Database by the inspector, clerk, or supervisor or their designee.

2.0 EQUIPMENT TO BE INSPECTED AND MAINTENANCE CODES

Wood Pole Mounted Street Light
Poles
Crossarms
Insulators
Primary
Transformers
Capacitor
Regulator
Sectionalizer
Recloser
Switches
Ground
Guy
Anchor
Secondary
Service
ROW
GIS
Spacer Cable
Cutout
Risers
Switchgear
Padmount Transformers
Enclosures

DISTRIBUTION FIELD SURVEY WORKSHEET

nationalgrid

REGION	DISTRICT	EMPLOYEE ID	DATE
FEEDER	TAX DISTRICT/TOWN	MAP #	
LINE # / ROUTE #	POLE #/SUFFIX #		
LOCATION			
# MAIN LINE CATV ATTACHMENT 1 2 3 4 5	# MAIN LINE TELEPHONE ATTACHMENT 1 2 3 4 5	STREET LIGHT ATTACHED ☐ Yes ☐ No	

WOOD POLE MOUNTED STREET LIGHT	P/Q	SECTIONALIZER	P/Q	CUTOUT	P/Q
098 1,2,9 (NR) ☐ Street Light Hazard Cond.	/	180 1,2,9 (NR) ☐ Oil Weeping	/	280 1,2,9 (R) ☐ Defective Cutout	/
099 2,9 (NR) ☐ Not Bonded	/	181 1,2 (R) ☐ Bushings Broken/Cracked	/	281 2 (R) ☐ Potted Porcelain	/
POLE		182 2,9 (R) ☐ Missing Ground Wire	/	282 4 (NR) ☐ Banded Porcelain	/
106 3 (NR) ☐ Dbl Wood-NG Trnsf Req'd	/	183 4 (NR) ☐ Control Cab Height/Ground	/	283 4 (NR) ☐ Enclosed	/
107 4 (NR) ☐ Dbl Wood-Tel Trnsf Req'd	/	184 3,9 (R) ☐ Improper/Missing Bond	/	284 4 (NR) ☐ Non Porcelain	/
108 4 (NR) ☐ Dbl Wood-CATV Trnsf Req'd	/	185 3,9 (R) ☐ Animal Guard Missing	/	285 4 (NR) ☐ Hybrid	/
110 1,2,9 (R) ☐ Broken/severely damaged	/	186 3,9 (R) ☐ LA Blown/Missing/Improper	/	286 4 (R) ☐ SpurTap Not Fused	/
111 1,2,3,4 (RP) ☐ Visual Rotting Grd Line	/	**RECLOSER**		289 4 (NR) ☐ Other	/
113 3 (NR) ☐ CuNap Treated Bthmark Yr	/	190 1,2,9 (NR) ☐ Oil Weeping	/	**RISER**	
114 2,4 (R) ☐ Woodpecker Holes	/	191 1,2 (R) ☐ Bushings Broken/Cracked	/	290 1,2,3,9 (NR) ☐ Improp Cable Supp/Term	/
115 1,2,3,9 (NR) ☐ Riser Guard Req'd	/	192 2,9 (R) ☐ Missing Ground Wire	/	291 2,9 (R) ☐ Improper/Missing Bond	/
116 1,2,3,4 (RP) ☐ Visual Rotting Pole Top	/	193 4 (NR) ☐ Control Cab Height/Ground	/	292 3,9 (R) ☐ Animal Guard Missing	/
117 1,2 (NR) ☐ Leaning Pole	/	194 3,9 (R) ☐ Improper/Missing Bond	/	293 2,3,9 (R) ☐ LA Blown/Missing/Improper	/
118 P (NR) ☐ Stencil / Correction Req'd	/	195 3,9 (R) ☐ Animal Guard Missing	/	**INFRARED**	
119 4 (NR) ☐ Bird's Nest	/	196 2,3,9 (R) ☐ LA Blown/Missing/Improper	/	400 1,2,3,9 (R) ☐ Problem - Switch	/
CROSSARM		**SWITCH**		401 1,2,3,9 (R) ☐ Problem - Cutout	/
120 1,2,4,9 (R) ☐ Damage Arm	/	203 1,2 (R) ☐ Gang Oper'd Defective	/	402 1,2,3,9 (R) ☐ Problem - Splice	/
121 1,2,4 (NR) ☐ Loose/Defective Pins	/	204 1,2,3,9 (R) ☐ Single Phase Defective	/	403 1,2,3,9 (R) ☐ Problem - Other	/
122 3,9 (NR) ☐ Wooden Pine 13.2kv	/	205 3,9 (R) ☐ Improper/Missing Bond	/	**HANDHOLES**	
123 1,2,4 (R) ☐ Loose Brace, Hrdwr	/	207 3,4,9 (R) ☐ LA Blown/Missing/Improper	/	600 1,2,9 (NR) ☐ Broken/Damaged/Unsecured	/
124 1,2,4,9 (R) ☐ Damage Dbl Crossarm	/	208 2,9 (NR) ☐ Handle Not Bonded	/	602 P (NR) ☐ Missing Nomenclature	/
125 1,2,4,9 (R) ☐ Damage Alley Arm	/	**GROUND**		603 1 (R) ☐ Secondary Needs Repair	/
127 1,2,9 (R) ☐ Primary On Arm	/	210 1,2,9 (R) ☐ Wire Broken/Loose	/	604 4 (NR) ☐ Other (use comments)	/
INSULATOR		211 1,2,9 (R) ☐ Hazard Condition	/	**SWITCHGEAR**	
130 1,2 (R) ☐ Broken/Cracked/Flashed	/	212 3,4 (NR) ☐ Guard Req'd	/	651 1,2,3,9 (R) ☐ Barrier Brkn/Dmgd/Unsec	/
131 1,2,9 (R) ☐ Floating	/	213 3,4 (NR) ☐ Non Standard	/	652 1,2 (NR) ☐ Base Broken/Damaged	/
132 3,4 (NR) ☐ I7 Aluminum Capped	/	214 3,9 (NR) ☐ Not Bonded to Neutral	/	654 2,9 (R) ☐ Cable Not Bonded	/
133 3,9 (R) ☐ Non-Standard Voltage	/	**GUY**		656 2,9 (R) ☐ Door Broken/Damaged	/
134 3,4 (NR) ☐ AL Cap Assoc w/Switch/Fuse	/	220 P (NR) ☐ Guy Wire Marker	/	657 F (NR) ☐ Excessive Vegetation	/
PRIMARY		221 2,9 (NR) ☐ Not in Compliance w/Code	/	659 2,9 (R) ☐ Missing Ground	/
140 1,2,9 (R) ☐ Insuff. Grnd Clearance	/	222 3,9 (NR) ☐ Excessive Slack	/	660 P (NR) ☐ Missing Nomenclature	/
141 1,2,3,9 ☐ Damaged Cond/Brkn Strands	/	223 1,2,3,9 (R) ☐ Broken Wire	/	661 4 (NR) ☐ Other	/
142 1, F (NR) ☐ Limbs on Primary	/	225 4 (NR) ☐ Guy not Bonded/Isolated	/	662 4 (NR) ☐ Rusted/Paint Peeling	/
145 1,2,3,9 (R) ☐ Dmg'd Stirups/Connector	/	per Standards		**PAD TRANSFORMER**	
146 2,3 (R) ☐ Improper Sag	/	**ANCHOR**		672 1,2,3,9 (R) ☐ Bushing Broken/Cracked	/
147 4 (R) ☐ LA Missing Transition	/	226 1,2,3,9 (NR) ☐ Req'd - Jt. Owned	/	673 1,2,P (R) ☐ Door Broken/Damaged	/
148 4 (R) ☐ LA Missing End of Line	/	227 1,2,3,9 (NR) ☐ Req'd - Sole NG	/	675 1,2 (R) ☐ Elbows/Terminator/	/
149 3,9 (R) ☐ LA Blown	/	**SECONDARY**		Tracking/Burned	
TRANSFORMER		231 1,F (NR) ☐ Limb on Secondary	/	676 F (NR) ☐ Excessive Vegetation	/
150 1,2,9 (NR) ☐ Oil Weeping	/	232 1,2 (NR) ☐ Improper Sag	/	680 2,9 (R) ☐ Missing Ground	/
151 1,2 (R) ☐ Bushings Broken/Cracked	/	234 1,2,3,9 (NR) ☐ Floating	/	681 P (NR) ☐ Missing Nomenclature	/
152 2 (R) ☐ Missing Ground Wire	/	**SERVICE**		684 1,2,9 (NR) ☐ Oil Weeping	/
153 2,4 (R) ☐ LA Blown/Missing/Improper	/	240 1 (NR) ☐ Ins. Loose from House	/	685 1,2,3,4,9 (NR) ☐ Pad Broken/Damaged	/
155 4 (R) ☐ Animal guards required	/	241 1,F (NR) ☐ Limb on Service	/	686 4 (NR) ☐ Protection (Ballards)	/
156 3,9 (NR) ☐ Non Std Install of Gap	/	243 1 (NR) ☐ Non Std/Unsecured	/	687 4 (NR) ☐ Rusted/Paint Peeling	/
157 2,9 (R) ☐ Improper/Missing Bond	/	**ROW**		**ENCLOSURES**	
CAPACITOR		250 F (NR) ☐ Brush/Tree/Washout	/	740 1,2,3,4,9 (R) ☐ Base Broken/Cracked	/
160 1,2,9 (NR) ☐ Oil Weeping	/	**GIS**		741 1,2,3,9,P (R) ☐ Door Brkn/Dmgd/Unsec	/
161 1,2,9 (R) ☐ Bulging	/	260 4 (NR) ☐ Map Doesn't Match Field	/	742 1,2,3,9 (R) ☐ Elbows Tracking/Burned	/
162 1,2 (R) ☐ Bushings Broken/Cracked	/	261 4 (NR) ☐ Pole/Line Numbering Error	/	743 F (NR) ☐ Excessive Vegetation	/
163 2,9 (NR) ☐ Missing Ground Wire	/	262 4 (NR) ☐ Equip/Hardware/Missing	/	744 2 (NR) ☐ Missing Ground	/
164 2,9 (NR) ☐ Blown Fuse	/	263 4 (NR) ☐ Equip Removed in Field,	/	745 P (NR) ☐ Missing Nomenclature	/
165 3,9 (NR) ☐ Improper/Missing Bond	/	Remove From GIS		746 4 (NR) ☐ Rusted/Paint Peeling	/
166 3,9 (R) ☐ Animal Guard Missing	/	269 4I (NR) ☐ Other GPS/GIS Errors	/	**POLE INSPECTION**	
167 3,9 (R) ☐ LA Blown/Missing/Improper	/	**SPACER CABLE**		801 1,2,3,4,9 (NR) ☐ Identified Priority Pole	/
168 4 (NR) ☐ Control Cab Heigh/Ground	/	270 1,2,3,9 (R) ☐ Damaged/Missing Spacer	/	802 1,2,3,4,9 (NR) ☐ Identified Reject Pole	/
REGULATOR		271 1,2,3,9 (R) ☐ Bracket Damage	/	803 4 (NR) ☐ Excessive Checking	/
170 1,2,9 (NR) ☐ Oil Weeping	/	272 3,9 (R) ☐ Bracket Not Bonded	/	804 4 (NR) ☐ Climbing Inspection	/
171 1,2 (R) ☐ Bushings Broken/Cracked	/	273 3,9 (R) ☐ Messenger Not Bonded	/		
172 2,9 (R) ☐ Missing Ground Wire	/	274 3,9 (R) ☐ Messenger Guard Missing	/		
174 4 (NR) ☐ Control Cab Height/Ground	/	276 3,9 (R) ☐ Uncovered Splice	/	**KEY**	
175 3,9 (R) ☐ Improper/Missing Bond	/			P/Q = Priority / Quantity	
176 3,9 (R) ☐ Animal Guard Missing	/			NR = Maint. Code May Not Direct Affect Reliability	
177 3,9 (R) ☐ LA Blown/Missing/Improper	/			R = Maint. Code May Affect Reliability	
				RP = Maint. Code May Affect Reliability and Has Specific Program to Place to Address	

Comments:

NG0236 (01.11)

3.0 DISTRIBUTION MAINTENANCE DATA BASE

3.1 The Distribution Maintenance database consists of information collected in the field down loaded from the *Windows*® based hand held computer and data gathered from other sources entered from the desktop computer. The *Windows*® based hand held computer can be down loaded to any National Grid desk top computer that is connected to the network by an employee that has been authorized to perform this function. The Distribution Maintenance database is used by various departments throughout National Grid to generate maintenance reports and cost estimates.

3.2 The Distribution Maintenance database contains information to be used by Asset Strategy and Investment Planning to track maintenance codes that may affect reliability (R), affect reliability that have a specific program in place to address (RP), or may not directly affect reliability (NR):

4.0 MAINTENANCE SCHEDULE

4.1 Maintenance activities are scheduled by priority Levels. All “Level 1 Priority” conditions identified must be repaired/corrected within 1 week. All “Level 2 Priority” conditions identified must be repaired/corrected within 1 year. All “Level 3 Priority” conditions must be repaired within 3 years. Level 4 Priority is for inventory purposes only.

4.2 Once the Distribution Feeder is completed in the Distribution Maintenance Database or 21 days have elapsed since the inspection, the Level 2 and Level 3 Priority maintenance codes are downloaded into STORMS. Expense maintenance work goes straight to scheduling while the capital work goes to Distribution Design. Level 1 Priority maintenance codes are communicated by the Distribution Inspector directly to the field operations group for the area where the feeder is located.

5.0 COMPLETION OF MAINTENANCE CODES

5.1 Level 1 priority maintenance codes completion process:

5.1.1 Distribution Inspector contacts System Operations Dispatch (SOD) providing information on the Level 1 maintenance item and fills out a Level 1 Priority Report Form (page 10).

5.1.2 SOD generates a PowerOn order from Regional Control.

5.1.3 Inspections Supervisor captures PowerON ID # and details for Level 1 maintenance item status. Inspections Supervisor tracks Level 1 maintenance status with operations ensuring that the Level 1 item is completed within 1 week. Inspection Supervisor closes out the Level 1 maintenance item in the Distribution Maintenance Database by adding the PowerOn ID # number to maintenance record.

5.2 Level 2 and Level 3 priority maintenance codes are completed in the Distribution Maintenance database once the 699 requirement is completed in STORMS for the work request associated with the maintenance code.

ALL MAINTENANCE WORK IS TO BE COMPLETED PER NATIONAL GRID DISTRIBUTION STANDARDS.

ALL MAINTENANCE WORK PERFORMED THAT WAS IDENTIFIED ON THE WORK ORDER OR DISCOVERED DURING THE REPLACEMENT/REPAIR/CORRECTION OF THE ORIGINAL MAINTENANCE PROBLEM MUST BE LISTED ON THE DATABASE AND THEN CLOSED OUT WHEN COMPLETE.

Level "1" & Elevated Voltage Priority Report Form

Any Level "1" Priority or Elevated Voltage condition found must be called into Dispatch.

Feeder:_____

Line #:_____

Pole #:_____

Closest Meter #:_____

Street Address: _____

City/Town: _____

Level "1" Priority/Elevated Voltage condition found.

_____

_____

Call Dispatch to inform that this is either an Elevated Voltage call or an Inspection issue.

Dispatcher notified: _____

Date/Time: _____

Inspector: _____

6.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	04/01/11	This document supersedes document dated 08/17/09.

Appendix 11

NG-USA EOP UG006
Underground Inspection and Maintenance

GENERAL INFORMATION:

The purpose of this procedure is to outline the requirements for the patrol and maintenance activities associated with National Grid's underground transmission and distribution facilities.
The variance in inspection procedures in New York, Massachusetts, New Hampshire, and Rhode Island service territories is due to the requirements of New York Public Service Order 04-M-0159 and the Massachusetts Department of Telecommunications and Energy recommendations of December 9 2005, which is incremental to National Grid in New York and Massachusetts.

This program is designed for the patrol and designated maintenance of underground facilities on a five year schedule. The Inspector will record all required maintenance on an approved National Grid database.

The underground distribution facility maintenance items identified through this patrol are separated into four priority levels 1, 2, 3, and 4. The problem codes identified default to the appropriate priority level. The default priority level can be adjusted by the individual performing the inspection based on actual field conditions. These priority Levels are defined as follows:

Level 1- An identified facility/component or tree condition that must be repaired/replaced within 1 week.

Level 2 - Identified facility/component condition that must be repaired/replaced within 1 year.

Level 3 – Identified facility/component condition that must be repaired/replaced within 3 years.

Level 4 – This priority category is to collect inventory information on actual field conditions to be used by Investment Strategy and Work Planning.

All Level 1 priority conditions identified in the field shall be called in by the Underground Inspector as follows:

1. Notification by location:
    a. New York: contact System Operations Dispatch 1-877-716-4996.
    b. Bay State West and North & Granite: Westboro Control Center 1-508-389-9032.
    c. Bay State South, and Ocean State: Lincoln Control Center 1-401-335-6075.

2. Detailed information provided to the regional notification location:
    a. Identify yourself as a Company Underground Inspector and your work reporting area.
    b. Details of the Level 1 Priority Condition:
        i. Problem found.
        ii. District, Circuit/Feeder No., Line No., Tax District and Manhole/vault No.
        iii. Street address and any additional information that would assist in finding the location of the problem.
        iv. If you are standing by or have secured the location.

APPLICABILITY:

This procedure applies to all personnel involved with or responsible for the inspection or maintenance of underground transmission and distribution facilities.

DEFINITIONS:

Desktop Computer: A personal computer that is connected to the National Grid network and used to download the Hand Held device and retrieve the information in the form of reports.

Elevated Equipment Voltage Test: An A.C. rms voltage difference between utility equipment and the earth, or to nearby grounded facilities that exceeds the highest perceptible voltage levels for humans.

Hand Held Computer: An electronic data recording device that is used in the field to create a record of conditions found.

Hand-Hole: An enclosure identified for use in underground systems, provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating, or maintaining equipment or wiring or both.

Infrared Inspection: An inspection conducted to detect abnormal heating conditions associated with separable connectors. An infrared inspection is required before work begins in an enclosed space, enclosure, padmounted transformer or padmounted switchgear.

Inspector: A qualified worker who can identify deficiencies or non-standard construction conditions on National Grid facilities.

Manhole: An enclosure identified for use in underground systems, provided with an open or closed bottom, and sized to allow personnel to enter, for the purpose of installing, operating, or maintaining equipment or wiring or both.

Patrol: An assessment of National Grid facilities for the purpose of determining the condition of the facility and any associated components.

Secondary Splice Box: An enclosure identified for use in underground systems. A secondary splice box may be required where the customer's number of secondary cables exceeds the maximum allowed amount on the transformer.

Service Box: See Hand-hole

Submersible Equipment: Electric equipment such as transformers and switches that, are generally located within a Hand-hole, Manhole, or Vault.

URD: Underground Residential Distribution

UCD: Underground Commercial Distribution

Underground Distribution Facilities: Manholes, vaults, hand-holes and service boxes, padmounted equipment and the components and equipment contained in these structures. (See GENERAL INFORMATION above).

User: An individual who the program administrator has authorized to use the inspection reporting program.

Vault: An enclosure, above or below ground, which personnel may enter and which is used for the purpose of installing, operating, or maintaining equipment or wiring or both.

PROGRAM ADMINISTRATOR:

Distribution Engineering Services

SCOPE:

Underground Transmission and Distribution Facility Maintenance

I. Patrols
II. Equipment to be Inspected and Maintenance Codes
III. Maintenance database
IV. Maintenance Schedule
V. Completion of Maintenance Codes
VI. Responsibilities

I. PATROLS

1. New York

Inspection of underground equipment will be scheduled in such a manner that each underground facility will be examined once every five years. These patrols shall be completed by December 31st of the schedule year.

One-fifth of all underground utility components should be inspected each year. URD and UCD facilities shall be inspected on the existing overhead distribution circuit schedule. Additionally all riser poles are inspected in accordance with the Transmission and Distribution Overhead Inspection Programs, NG-USA EOP T007 and NG-USA EOP D004. Customer owned manholes and vaults that enclose National Grid equipment shall require the inspection of these National Grid facilities.

The Inspection group is responsible to create the patrol schedule for their respective Regions for the remainder of underground facilities. The Inspector uses a Windows based hand held computer to record region, district, employee ID, feeder number, structure ID number, GPS location, tax zone, line number, comments and maintenance problem codes. The Inspector while patrolling shall also complete the following maintenance codes if found deficient upon inspection: 602 – Handhole missing nomenclature, 617 – manhole missing nomenclature, 639 - network transformer- missing nomenclature, 660 – switchgear missing nomenclature, 681 – transformer missing nomenclature, and 707 – vaults improper nomenclature. The Inspector will input the code into the Windows based handheld as required, as well as completing the work unit in the handheld upon field completion while at the site. If the Inspector finds unmapped facilities from the information supplied from the Geographic Information System (GIS), refer to NG-USA EOP G011, Preparation and Distribution of Electric Facilities Records, for required procedure for corrections.

2. New Hampshire and Rhode Island

Inspection of designated underground equipment will be scheduled in such a manner that each designated Underground Facility will be examined once every five years. These patrols shall be completed by March 31h of the fiscal year.

One-fifth of all metallic handholes, padmount transformers and switchgear shall be inspected annually. The metallic handhole covers shall be opened for a visual inspection. An external visual inspection shall be completed on the padmount transformers and switchgear. Additionally all separable components in the

metallic handholes are to be inspected by infrared. Refer to NG-USA EOP UG001 for infrared procedure. A "Level 1 Priority" shall be assigned to a temperature gradient greater than 20º, although it is recognized that consideration must be taken as to whether a customer outage will occur at this time and the negative impact the outage could have on the customer. This may require scheduling an outage with the customer within one week to satisfy this requirement. A "Level 2 Priority" shall be assigned to a temperature gradient between 10º and 20º. A "Level 3 Priority" shall be assigned to a temperature gradient less than 10º. Additionally, an elevated equipment voltage test shall be completed at each location, refer to NG-USA EOP-G016.

A working inspection on underground facilities is required for all manholes, vaults, handholes, splice boxes, junction boxes, padmount transformers, switchgear and submersible equipment, each time a crew performs work at one of these facilities. The format for data collected shall follow this EOP. All separable components in these facilities are to be inspected by infrared. Additionally an elevated equipment voltage test shall be completed at each location, refer to NG-USA EOP-G016.

All transmission riser poles are inspected in accordance with the Transmission NG-USA EOP-T007.

The Inspection group is responsible to create the patrol schedule for their respective Regions for the designated underground facilities. The Inspector uses a hand held computer to record region, district, employee ID, feeder number, structure ID number, GPS location, line number, comments and maintenance problem codes. The Inspector, while patrolling or crew while inspecting, shall also complete the following maintenance codes if found deficient upon inspection, 602 – Handhole missing nomenclature, 617 – manhole missing nomenclature, 639 - network transformer- missing nomenclature, 660 – switchgear missing nomenclature, 681 – transformer missing nomenclature, and 707 – vaults improper nomenclature. The Inspector will input the code into the Windows based handheld as required, as well as completing the work unit in the handheld upon field completion while at the site. If the Inspector finds unmapped facilities from the information supplied from GIS, refer to NG-USA EOP G011, Preparation and Distribution of Electric Facilities Records, for required procedure for corrections. Crews performing working inspections are to follow the same protocol for inspections by using either a handheld data entry unit or paper inspection logs requiring data entry by clerical support.

3. Massachusetts

Inspection of designated underground equipment will be scheduled in such a manner that each designated Underground Facility will be examined once every five years. These patrols shall be completed by March 31 of the fiscal year.

One-fifth of all manholes, vaults, metallic handholes, padmount transformers and switchgear shall be inspected annually. The metallic handhole covers shall be opened for a visual inspection. Manholes and vaults shall be opened and entered for inspection. An external visual inspection shall be completed on the padmount transformers and switchgear. Additionally all separable components in the metallic handholes, manholes, and vaults are to be inspected by infrared. Refer to NG-USA EOP UG001 for infrared procedure. A "Level 1 Priority" shall be assigned to a temperature gradient greater than 20º, although it is recognized that consideration must be taken as to whether a customer outage will occur at this time and the negative impact the outage could have on the customer. This may require scheduling an outage with the customer within one week to satisfy this requirement. A "Level 2 Priority" shall be assigned to a temperature gradient between 10º and 20º. A "Level 3 Priority" shall be assigned to a temperature gradient less than 10º. Additionally, an elevated equipment voltage test shall be completed at each location, refer to NG-USA EOP-G016.

A working inspection on underground facilities is required for all manholes, vaults, splice boxes, junction boxes, padmount transformers, switchgear and submersible equipment, each time a crew performs work at one of these facilities. The format for data collected shall follow this EOP. All separable components in these facilities are to be inspected by infrared. Additionally an elevated equipment voltage test shall be completed at each location, refer to NG-USA EOP-G016.

All transmission riser poles are inspected in accordance with the Transmission NG-USA EOP-T007.

The Inspection group responsible to create the patrol schedule for their respective Regions for the designated underground facilities. The Inspector uses a hand held computer to record region, district, employee ID, feeder number, structure ID number, GPS location, line number, comments and maintenance problem codes. The Inspector, while patrolling or crew while inspecting, shall also complete the following maintenance codes if found deficient upon inspection, 602 – Handhole missing nomenclature, 617 – manhole missing nomenclature, 639 - network transformer- missing nomenclature, 660 – switchgear missing nomenclature, 681 – transformer missing nomenclature, and 707 – vaults improper nomenclature. The Inspector will input the code into the Windows based handheld as required, as well as completing the work unit in the handheld upon field completion while at the site. If the Inspector finds unmapped facilities from the information supplied from GIS, refer to NG-USA EOP G011, Preparation and Distribution of Electric Facilities Records, for required procedure for corrections. Crews performing working inspections are to follow the same protocol for inspections by using either a handheld data entry unit or paper inspection logs requiring data entry by clerical support.

II. EQUIPMENT TO BE INSPECTED AND MAINTENANCE CODES

This EOP requires the visual inspection of the following facilities as designated above for New York, New Hampshire, Rhodes Island or Massachusetts, which require opening, and may require pumping on some items to assure a proper inspection:

- Manholes
- Vaults
- Handholes – non-fiberglass
- Splice boxes – non-fiberglass
- Junction boxes – non-fiberglass
- Pad mount transformers
- Pad mount switchgears
- Submersible equipment
- Handholes – fiberglass do not require opening
- Splice boxes – fiberglass do not require opening
- Junction boxes – fiberglass do not require opening

.

Maintenance Codes are shown on the Underground Field Survey Worksheet (Table 1). The Underground Field Survey Worksheet can be used by the field to record maintenance items and is used for informational purposes only. The latest transmission maintenance codes are downloaded to the Hand Held Computer each time there is a change that affects the maintenance code table contained in the Underground Maintenance Database. Printed copies of the latest maintenance code tables may be obtained by running a report on the look up tables from the Underground Maintenance Database.

INSPECTION PROGRAM AND MAINTENANCE CODES
TABLE 1

UNDERGROUND FIELD SURVEY WORKSHEET		
DATE:	INSPECTOR NAME:	EMPLOYEE ID
DIVISION	DISTRICT	FEEDER:

TOWN:	STREET:	POLE, MANHOLE, VAULT #	SUFFIX #

Handhole		Manhole		Net Protect		Net XFMR's		Switchgear		Transformer			
Vault		Trench		Submersible		Pull Box		Other		Equipment #			

MANHOLES, HANDHOLES, VAULT STRUCTURES
Water (in hole) Yes No

EV Test Required: Yes No Voltage Action Taken: Repaired De-energized
EV Found Voltage: Yes No

Gas Monitor Readings		Alarm Setting
Lower Explosive Limit (LEL)		10% or above
Oxygen (0_2)		% below 19.5, above
Carbon Monoxide (CO)		33 ppm
Hydrogen Sulfide (H_2S)		10 ppm

GIS	P/Q
260 **4** (NR) GIS map doesn't match field	/
261 **4** (NR) GIs Pole/line numbering in error on GIS	/
262 **4** (NR) GIS equip/hardware missing in GIS	/
263 **4** (NR) GIS equip removed in field, remove from GIS	/
269 **4** (NR) GIS Other GPS/GIS Errors	/
HANDHOLES	
600 **2** (NR) Broken/damaged/unsecured	/
602 **P** (NR) Missing nomenclature	/
603 **1** (R) Secondary needs repair	/
604 **4** (NR) Other (use comments)	/
MANHOLE	
610 **2** (NR) Ground rods missing	/
611 **2** (R) Cable/Joint leaking	/
612 **2** (NR) Cables bonded/grid defective	/
614 1,2,3,**4** (NR) Cracked/broken	/
615 **3** (R) Fire proofing	/
616 **4** (NR) Improper grade	/
617 **P** (NR) Missing nomenclature	/
620 **2** (NR) Rerack	/
621 1,2,**3**,4 (NR) Ring/cover repair/replace	/
622 1,**4** (NR) Roof condition – use comments	/
623 1,**4** (NR) Chimney Condition – comments	/
624 **4** (NR) Manhole needs cleaning	/
625 **1** (R) Secondary needs repair	/
626 4 (NR) No Holes in Manhole Cover	/
NETWORK PROTECTOR	
630 **2** (R) Barriers broken/damage	/
632 **1** (R) Oil leak	/
633 **2** (NR) Worn/damaged gasket	/
NETWORK TRANSFORMER	
635 **2** (R) Bushing Broken/cracked	/
637 **2** (R) Low oil	/
638 **1** (NR) Missing ground	/
639 **P** (NR) Missing nomenclature	/
642 1, **2** (R) Oil Weeping	/
643 **4** (NR) Rusted/paint peel	/
SWITCHGEAR	
651 1,**2**,3 (R) Barrier broken/damaged/unsecure	/
652 1,2,**3** (NR) Base broken/damaged	/
654 **2** (R) Cable not bonded	/
656 1,**2**,3 (R) Door Broken/Damaged	/

SWITCHGEAR	P/Q
657 **F** (NR) Excessive vegetation	/
659 **2** (R) Missing ground	/
660 **P** (NR) Missing nomenclature	/
661 **4** (NR) Other	/
662 **4** (NR) Rusted/Paint Peeling	/
TRANSFORMER	
672 1,2,**3** (R) Bushing Broken/Cracked	/
673 1,**2**,3 (R) Door Broken/damaged/unsecure	/
675 1,2,**3** (R) Elbows/tracking/burned	/
676 **F** (NR) Excessive vegetation	/
680 **1** (R) Missing Ground	/
681 **P** (NR) Missing nomenclature	/
682 **4** (NR) Mud/debris	/
684 1,**2** (NR) Oil Weeping	/
685 1,2,**3**,4 (NR) Pad broken/damaged	/
686 **4** (NR) Protection (ballards) damage	/
687 **4** (NR) Rusted/Paint peeling	/
688 1,**2** (NR) Pad Pushed Off Base	/
TRENCH	
690 **1** (R) Exposed Cable	/
692 **4** (NR) Path – Sunken	/
VAULTS	
700 **2** (NR) Cable missing bond	/
702 1,2,3,**4** (NR) Cracked/broken	/
703 1,2,**4** (NR) Damaged/broken cover	/
704 1,2,**4** (NR) Damaged/broken door	/
705 1,**2**,4 (NR) Damaged/broken ladder	/
706 1,2,**3**,4,P (NR) Improper grade	/
707 4,**P** (NR) Improper nomenclature	/
708 **4** (NR) Light not working	/
712 **4** (NR) Sump pump broken	/
713 **1** (R) Secondary needs repair	/
SUBMERSIBLE EQUIPMENT	
720 1,2,3,**4** (R) Excess Corrosion	/
721 1,2,3,**4** (R) Physical damage	/
722 1,**2** (R) Leaking	/
ANODES	
730 **3** (R) Missing	/
731 **3** (NR) Need replacement	/

KEY
PQ = Priority Quantity
NR = Maint.Code May Not Directly Affect Reliab.
R = Maint. Code May Affect Reliability
RP = Maint. Code May Affect Reliab. and Has Specific Program to Place to Address

Comments:

NG-0244 7/09

III. MAINTENANCE DATABASE

The Maintenance database consists of data downloaded from the Windows based hand held and data entered from the desktop computer. The Windows based hand held used in the field, can be downloaded to any National Grid desk top computer that is connected to the network and the inspector is logged on as a valid user of the UG Maintenance program. The National Grid desktop computer is also used to generate various reports and work tickets depending on the user's need. These reports are utilized to schedule and accomplish distribution maintenance work.

IV. MAINTENANCE SCHEDULE

Maintenance activities are scheduled by priority Levels. All "Level 1 Priority" conditions identified must be repaired/corrected within 1 week. All "Level 2 Priority" conditions identified must be repaired/corrected within 1 year. All "Level 3 Priority" conditions must be repaired within 3 years. Level 4 Priority is for inventory purposes only.

Once the Underground Circuit/Feeder is completed in the Underground Maintenance Database, the Level 2 and Level 3 Priority maintenance codes are downloaded into STORMS. Expense maintenance work goes straight to scheduling while the capital work goes to Underground Engineering. Level 1 Priority maintenance codes are communicated by the Underground Inspector directly to the field operations group for the area where the feeder is located.

V. COMPLETION OF MAINTENANCE CODES

The completion of Level 1 priority maintenance codes is performed by the field operations Supervisor or their designee. Level 2 and Level 3 priority maintenance codes are completed in the Underground Maintenance database once the 699 requirement is completed in STORMS for the work request associated with the maintenance code.

ALL MAINTENANCE WORK IS TO BE COMPLETED PER NATIONAL GRID UNDERGROUND CONSTRUCTION STANDARDS.

VI. RESPONSIBILITIES:

Distribution Engineering Services

1. Update program as necessary.

Customer Operations

1. Ensure the Underground Maintenance Program as outlined in this EOP is implemented properly and timely.
2. Select circuits to be patrolled for a running five-year cycle and ensure that the circuits scheduled for patrol are completed each year.
3. Provide qualified personnel as the inspectors, to provide consistent and accurate identified maintenance concerns/problems.
4. Ensure program is completed annually as required.

Underground Inspector

1. Demonstrate the ability to identify maintenance concerns and the aptitude to become proficient in the use of a hand held computer and desktop computer.
2. Demonstrate the understanding and requirements of this EOP.
3. Possess the ability to do walking patrols, collect information on a hand held, download to a desk top computer, edit data, provide requested information/reports/work tickets to supervision, and track/close out work completed in the database.

Contract Management Services

1. At the request of Customer Operations/Distribution Network Strategy obtain, schedule and manage contractors to perform inspections and perform required maintenance.
2. Ensure the Underground Maintenance Program as outlined in this EOP is implemented properly and timely.
3. Provide inspectors where applicable.
4. Ensure inspectors are trained.
5. Provide program management.
6. Ensure program is completed annually as required.

Asset Strategy and Policy

1. Provide input into program revisions.
2. Provide program management.
3. Ensure program is completed annually as required.
4. Ensure the Underground Maintenance Program as outlined in this EOP is implemented properly and timely.

Process and Systems

1. Provide and support database.

T&D Technical Training

1. Provide training upon request.

REFERENCE:

NY PSC Order 04-M-0159
NY PSC Order Order Adopting Changes to Electric Safety Standard, December 2008
Applicable National Grid Safety Rules and Procedures
Distribution Line Patrol and Maintenance NG-USA EOP D004
Elevated Equipment Voltage Testing NG USA EOP-G016
Transmission Line Patrol and Maintenance NG USA EOP – T007
Massachusetts DTE Directive 12/9/05

NG-USA EOP UG006

“Underground Inspection and Maintenance”

08/17/09

Changed levels from ABC to 1234 and added Underground Field Survey Worksheet.

Appendix 12

PR 06.01.601.001
Transmission Line Maintenance Procedure

Ground Based Visual Inspection

Revision History

Version	Date	Revision	Author	Reviewer	Approver
1.0	02/02/2010	Initial	J.M.McGrath		M.S.Browne
2.0	01/07/2011	Code changes, corrections	J.M.McGrath		M.S.Browne
2.1	2/3/2011	Code changes, warning sign revision, changed wood pole evaluation methodology	J.M.McGrath		M.S.Browne

Note: This document supersedes EOP T007 – Transmission Line Patrol and GL 06.01.118 – Visual Inspection of Transmission Line Assets

Table of Contents

FORWARD

1.0 General

1.1 The purpose of this procedure is to outline the requirements for the visual Inspection from ground level of National Grid US transmission circuits.

1.2 All applicable safety and environmental rules must be followed when executing these Inspections. Inspectors shall be aware of hazards that may be encountered.

1.3 Inspectors shall be notified by TLOME for all changes to this document and are to be trained yearly on this procedure. New Inspectors shall be trained on this document prior to performing this inspection.

1.4 This procedure is associated with Specification SP.06.01.601.000, Transmission Line Inspection and Maintenance.

2.0 Administration

2.1 Maintenance of this document is the responsibility of Transmission Line Operations and Maintenance Engineering (TLOME).

2.2 Specific planned work performed under this procedure will be coordinated by TLOME via a Work Plan document to be released prior to the start of each fiscal year.

3.0 Application

3.1 This document applies to all overhead line assets managed by National Grid US Transmission as defined by Transmission Group Procedure 12 (TGP 12) and applies to anyone performing Inspection and Maintenance activities on these assets. It is expected that this procedure be executed by Qualified Personnel as determined by training specific to the task performed.

4.0 References

4.1 Transmission Line Inspection and Maintenance Specification, SP.06.01.601.000

4.2 Transmission Line Switch Inspection Procedure, PR.06.01.601.008

4.3 Transmission Wood Pole Inspection and Treatment Procedure, PR.06.01.601.005

4.4 Transmission Steel Structure Foundation/Footer Inspection and Repair SP.06.01.601.004

4.5 National Grid Employee Safety Handbook

5.0 Definitions

5.1 Ground Based Visual Inspection – An Inspection performed from a stationary ground position. Movement along the line between Inspection points may be by vehicle or foot

5.2 Hand Held Computer – A data recording device that is used in the field to create a record of conditions found for the purposes of communicating this data to a Maintenance Management System

5.3 Inspection – A careful viewing of assets to find defects and other problems that require Maintenance or monitoring

5.4 Inspection and Maintenance Program – National Grid's planned program for Inspecting and Maintaining its transmission lines.

5.5 Inspector – Qualified Personnel who identify defects via a specific type of Inspection

5.6 Maintenance – Work to correct defects or other problems. This work is often generated through the Inspection process

5.7 Maintenance Management System (MMS) – A computer application that schedules and tracks Inspections and/or Maintenance work

5.8 National Grid Representative – National Grid personnel designated as the point of contact for a contracted inspector

5.9 Pocket – A void in a pole resulting from damage, weathering or decay. This may lower the strength of the pole.

5.10 Qualified Personnel – Personnel trained to safely perform a specific Inspection.

5.11 Work Plan – A document published each fiscal year that, among other things, lists all Inspection and Maintenance scheduled for the year.

6.0 Follow Up Prioritization

6.1 Assets are to be assessed as follows:

- All assets are to be graded based on worst critical member/location or discrete area, i.e. the weakest link of the asset.
- Each steel structure, pole or member is to be graded according to Sections 10 and 11 of this procedure, using scales found in Appendix B, for engineering reference.
- Each concrete foundation is to be graded according to Section 12 of this procedure, using scales found in Appendix C, for engineering reference.
- Switches shall be inspected according to Procedure Section 21. Defects shall be assigned a Maintenance Priority Level of 1 to 4 per Appendix I.
- All other assets shall be inspected according to the applicable section and defects found shall be assigned a Maintenance Priority Level of 1 to 4 in accordance with Appendices D-I.

6.2 Once reported, defects shall be repaired or addressed as follows per Transmission Line Inspection and Maintenance Specification, SP.06.01.601.000:

- Level 1 – Address within 1 week*
- Level 2 – Address within 6 months**
- Level 3 – Address within 3 years**
- Level 4 – Monitor condition or use for studies

* Time period starts on the day the problem is found
**Time period starts when the defect is entered into Computapole

6.3 Any exceptions to the grading guide below shall only be made with approval of TLOME. Any changes to levels already entered into Computapole shall only be made with approval of TLOME.

6.4 All Level 1 conditions shall be reported no later than two hours after discovery as follows:

- New York – Contact Transmission Control Center @ (315) 460-2110
- New England – Contact Transmission Control Center @ (800) 423-6029

- Indicate problem found
- Indicate circuit and structure number
- Indicate street address and any additional information that would assist in identifying the location
- Indicate if you are standing by or have safely secured the location
- Indicate whether someone from In House Construction or Engineering is required for evaluation (immediate or not)

6.5 In cases where, in the judgment of the inspector, a serious safety issue may exist, the Inspector may be required to stand by a defect until other personnel arrive. This may be by the decision of the inspector or other groups. It is extremely important that the Inspector keep themselves and others a safe distance away from any hazards that are encountered. In such cases, the Safety group or National Grid Representative may also be advised.

7.0 Documentation

7.1 Information gathered from the Ground Based Visual Inspection shall be documented in the Computapole Maintenance Management System via the Hand Held Computer. If the computer isn't available, information can be temporarily documented on the Transmission Field Survey Worksheet in Appendix A.

8.0 Other Inspections

8.1 This document may be utilized in conjunction with other Inspections and condition assessments such as engineering walk-downs etc. by personnel not typically engaged in Inspections. If any defects are found that are considered Level 1, it is expected that Section 6 above shall be followed. All Level 1 and 2 defects found shall also be reported to the following:

- Manager of TLOME, via phone or email, as soon as possible.

8.2 It is strongly encouraged that Level 1 and 2 defects found be evaluated by personnel from In House Construction or Transmission Inspections as soon as possible. This may not be necessary if the Inspection is being performed by someone with sufficient knowledge of transmission line construction that can fully understand the impact of the defect.

9.0 Responsibilities

9.1 Transmission Line O&M Engineering

- Create the transmission line portion of the Work Plan outlining the circuits that are to be inspected and otherwise addressed according to this specification in a given fiscal year.
- Provide guidance and support for the execution of the Inspection and Maintenance Program
- Approve exceptions as noted above

9.2 System Delivery

- Ensure the Inspection Program as outlined in the Fiscal Year Work Plan is safely executed according to this specification and its associated procedures in a timely manner.
- Repair problems found during Inspection

9.3 Transmission Inspections

- Provide National Grid Representative when contractors are used
- Be qualified to perform specific Inspections and identify defects.
- Be qualified to perform applicable basic Maintenance such as the installation of guy guards and stenciling.
- Follow all applicable National Grid US Safety Rules.
- Demonstrate the understanding and requirements of this specification and all related procedures and guidelines.

9.4 Transmission Investment Management

- Track performance of Work Plan completion
- Track performance of Maintenance within assigned priority level time frames

9.5 Transmission Network Asset Strategy

- Provide input into program revisions.

PROCEDURE

10.0 General

10.1 All assets must be physically visited and visually inspected so that all potential defects can be identified. Exceptions must have approval from the appropriate department manager and be documented in the Maintenance Management System.

10.2 The intent of this procedure is to visit assets in order as they physically exist in the field and apply the appropriate Inspection to each asset. To conform to the current Maintenance Management System input process, the steps in this procedure are arranged so as to line up numerically with the Computapole Maintenance priority codes.

10.3 All elements of this procedure are intended to be performed from ground level. Tools to facilitate a clear, close up view of assets, such as binoculars or scopes, should be used where necessary.

10.4 Some Computapole codes do not apply to this Inspection and are not included in this procedure. A complete list of Computapole codes including valid levels and STORMS qualifiers is in Appendix J.

11.0 Inspect Steel Condition

11.1 Grading Reference:

- Appendix B - Steel Evaluation Categories (1-6 Rating)

11.2 Inspection Note:

- Grade all steel collectively. The overall tower rating shall be assigned as the visual rating of the worst 5% of members on the tower or discrete area on the steel pole, or the visual rating of the worst critical members, e.g. tower legs and insulator attachment points, whichever is worse.
- Structures rated as 4 or worse will require additional review, so additional photos and notes should be taken to assist in structure evaluation.
- At the discretion of the Inspector, any structure may be classified as 6 “Very Severe Deterioration” due to special circumstances. The reason for this must be reported in the Inspection report.

11.3 Visually inspect for the following:

- Steel condition
- Weathering steel for excessive corrosion of joints. Report any excessive corrosion of weathering steel joints to Transmission Line O&M Engineering.

12.0 Inspect Steel Grillage Foundation

12.1 Grading Reference:

- Appendix B - Steel Evaluation Categories (1-6 Rating)

12.2 Visually inspect for the following:

- Steel condition above grade

13.0 Inspect Concrete Foundation

13.1 Grading Reference:
- Appendix C - Concrete Evaluation (1-5 Rating)

13.2 Inspection Note:
- At the Inspector's discretion, any structure foundation may be classified as 5: Very Severe Deterioration. The reason for this must be given in the Inspection report.

13.3 Visually inspect for the following:
- Poor workmanship, including honeycombing
- Cracking, including pattern or solitary cracks
- Disintegration and deterioration of concrete
- Distortion/movement resulting in change in alignment of structure components
- Seepage – movement of water/fluids through pores
- Spalling – development of fragments
- Delamination
- Degradation of steel/concrete interface
- Excessive corrosion of reinforcement
- Condition of anchor bolts. Ensure all hardware present and tight.

14.0 Inspect Wood Poles and Structures - Overall

14.1 Grading Reference:
- Appendix D (Maintenance Priority Level 1-4 Rating)

14.2 Sound pole, visually inspect for the following and grade using the indicated code (note – unless an immediate risk of failure exists, poles with visual rotting and/or hollow sound should be classified as a Level 4 and scheduled for a Wood Pole Inspection):
- Code 510 - Broken
- Code 511 - Visual rotting/hollow sounding pole
- Code 512 - Leaning
- Code 513 - Replace single arm
- Code 514 - Replace double arm
- Code 515 - Repair brace
- Code 516 - Replace brace
- Code 517 - Replace anchor
- Code 518 - Install anchor
- Code 519 – Repair/replace guy wire
- Code 521 - Tighten guy wire
- Code 522 - Replace guy shield
- Code 524 - Guy bonding
- Code 525 - Lightning damage
- Code 526 - Woodpecker damage
- Code 527 - Insects
- Code 528 - Aerial number missing

15.0 Inspect Wood Poles – Individual

15.1 Grading Reference:
- Appendix E (Maintenance Priority Level 1-4 Rating)

15.2 Note: A C-Truss repair is not considered a temporary repair. However, if a pole with a C-Truss is significantly deteriorated, it shall be graded as if no C-Truss was installed.

15.3 Identify via badge left after Wood Pole Groundline Inspection. Use only Level 4 and are meant to be a documentation of pole labeling that results from the Wood Pole Groundline Inspection:
- Code 901 - Identified priority pole
- Code 902 - Identified reject pole
- Code 903 - Excessive checking
- Code 904 - Climbing inspection required
- Code 905 - No inspection tag

16.0 Inspect Steel Poles and Structures

16.1 Grading Reference:
- Appendix F (Maintenance Priority Level 1-4 Rating)

16.2 Visually inspect for the following and grade using the indicated code:
- Code 531 - Broken legs
- Code 532 - Aerial number missing
- Code 534 - Loose or missing bolts/hardware
- Code 535 - Anti climb equipment damaged/missing
- Code 536 - Vegetation on tower
- Code 537 - Structure damage
- Code 538 - Tower needs straightening
- Code 539 - Arms damaged

17.0 Inspect Conductor

17.1 Grading Reference:
- Appendix G (Maintenance Priority Level 1-4 Rating)

17.2 Note: TLOME may revise levels for conductor damage based on factors such as mechanical and electrical loading.

17.3 Visually inspect for the following and grade using the indicated code:
- Code 541 - Conductor condition overall
- Code 542 - Static wire condition overall
- Code 543 - Ground wire condition overall
- Code 544 - Sleeve/splice/connector condition
- Code 546 - Clearance issues

18.0 Inspect Insulators/Hardware

18.1 Grading Reference:
- Appendix G (Maintenance Priority Level 1-4 Rating)

18.2 Note – Where multiple strings of insulators are encountered, each string shall be evaluated on its own.

18.3 Visually inspect for the following and grade using the indicated code:
- Code 551 - Insulator damage
- Code 552 - Insulators out of plumb
- Code 553 - Hardware loose or damaged
- Code 555 - Lightning arrestor issues

19.0 Inspect Foundation – General

19.1 Grading Reference:
- Appendix H (Maintenance Priority Level 1-4 Rating)

19.2 Visually inspect for the following and grade using the indicated code:
- Code 563 - Erosion

20.0 Inspect Right of Way

20.1 Grading Reference:
- Appendix I (Maintenance Priority Level 1-4 Rating)
- All Code 574 – Danger Trees rated as an "F"

20.2 Visually inspect for the following and grade using the indicated code:
- Code 571 - Erosion
- Code 572 - Encroachments
- Code 573 - Debris
- Code 574 - Danger trees
- Code 575 - Broken gates
- Code 576 - Oil/Gas/Hazmat leak

21.0 Inspect Miscellaneous

21.1 Grading Reference:
- Appendix I (Maintenance Priority Level 1-4 Rating)

21.2 Visually inspect for the following and grade using the indicated code:
- Code 581 - Structure not marked – ground level
- Code 582 - Switch damaged (see below)
- Code 583 - Switch ground damaged (see below)
- Code 584 - Install warning sign
- Code 585 - Replace warning sign
- Code 586 - Remove steps
- Code 587 - Add dirt and tamp
- Code 589 - Bird Nest
- Code 590 - Excessive bird perching

22.0 Inspect Switch – Visual Inspection

22.1 Grading Reference:
- Appendix I (Maintenance Priority Level 1-4 Rating)

22.2 Inspection Note:
- This inspection can be performed from the ground with the switch in service. Refer to the Line Switch Inspection Procedure, PR06.01.601.008 for further

information. Since one code is used for most of this inspection, note problem details.

22.3 Visually inspect for the following and grade using the indicated code:

- Code 582 Noise – Arcing and other abnormal noise, if energized. If disconnect switches are making unusual noises while energized, leave the area immediately and contact the appropriate control center.
- Code 582 Insulators – Surface contamination, tracing, damaged porcelain
- Code 582 Primary Connections – Discoloration of or heat rising from connections (overheating), cracks, visibly loose connections
- Code 582 Live Parts – Blades properly turned into jaws (horizontal), damaged or misaligned arcing horns, damaged, misaligned or missing parts
- Code 582 Load break interrupters – Damage or deterioration
- Code 582 Operating mechanism – Properly locked, operating pipe for breakage, bending, phase to phase linkage for breakage, bending, manual operating mechanism for damage, deterioration or missing parts
- Code 583 Operating mechanism properly grounded

23.0 Document GIS Data Issues

23.1 Grading Reference:

- Appendix I (Maintenance Priority Level 1-4 Rating)

23.2 Document all mismatches between the GIS and the field as follows:

- Code 760 - GIS map mismatch
- Code 761 - GIS – equipment stencil mismatch
- Code 762 - GIS – equipment/hardware missing
- Code 763 - GIS – equipment removed in field
- Code 769 - GIS – other GPS/GIS errors

24.0 Engineering-Specific Inspection

24.1 This section contains additional guidelines for Inspections related to engineering activities and is not to be included in the regular Ground Based Visual Inspection. The guidelines presented below shall be used by engineers completing and interpreting field Inspections as part of preliminary engineering as specified in SP.06.01.101 “Transmission Engineering and Design Services”.

24.2 The sum total of the guidance provided in sections 9 through 23 shall be used in completing engineering analysis of lines.

24.3 Notes on Priority Codes

- Priority 1 – Reserved for immediate and substantial threats to public safety and/or system reliability. These should generally be very rare
- Priority 2 – Items which require repair due to a near term risk of failure, the repairs should not wait for the normal two-year project life cycle
- Priority 3 – Repairs are required, but a more deliberate approach can be taken over a two-year period

- Priority 4 – Repairs should be completed if the work is incidental to another project, but the item can wait for the next Inspection cycle for further assessment

24.4 The following features or defects shall be determined and documented:

- Asset Information
  - Structure Number
  - Circuit
  - Tower/Pole ID# including circuit according to National Grid nomenclature
  - Tower/Pole Location in Latitude/Longitude format
  - Tower/Pole Groundline elevation
  - Structure location (City/Town and State)
- Visual Inspection
  - Year Installed
  - Tower/Pole Height
  - Structure Height
  - Structure Type
  - Structure Description (painted/galvanized/weathered/foundation)
  - Structure condition(s) and overall rating
  - Presence of steel distress or deterioration
  - Concrete foundation condition(s) and overall rating
  - Presence of concrete foundation distress or deterioration
  - Concrete foundation surface mapping diagram
  - Mechanical or fire damage
  - Broken hardware such as insulators or adversely impacted structural components such as foundations
  - Adjacent roads, railroads, parks, and other areas considered frequently accessible by the general public
  - Any unusual conditions or safety hazards
  - Digital photographs
  - Field sketches of foundation condition

25.0 Temporary Repairs

25.1 Some defects encountered may have been repaired temporarily. These defects shall be inspected monthly by Transmission Inspections, until a permanent repair is completed.

25.2 If an Inspector encounters a temporary repair, the defect shall still be reported with a note indicating a temporary repair.

Appendix A – Transmission Field Survey Worksheet

TRANSMISSION FIELD SURVEY WORKSHEET

Patrolled Circuit/No.	Unique ID	Pole/Tower No.	Voltage	District
Additional Circuit/No.	Unique ID			

Area	Date	Employee ID
Between _____Rd. And _____Rd.		

TYPE	
	□ A) Single □B) H. Frame □C) 3 Pole □D) 4 Pole □E) 5 Pole □F) 6 Pole □G) Flex-Tower □H) Square-Tower □I) Hairpin □J) Other
MATERIAL	□ A) Wood (fill in information for each pole, i.e., 2 pole, 3 pole, 4 pole, etc.) Height _____ Class _____ Year Set _____ Manufacturer _____ Year Last Treated _____ Treatment □A) External □B) Internal □C) Both □D) Other □E) Unknown □F) None □ B) Steel □ C) Lattice
CONFIGURATION	□Deadend □Tangent □Switch Structure □Davit Arm □Stand Off □Other

STEEL/LATTICE CONDITION	(Circle One) 1 2 3 4 5 6	FOUNDATION: STEEL CONCRETE	(Circle One) 1 2 3 4 5 6 1 2 3 4 5

POLE * *Enter Sub No. if a Multiple Structure	Sub. No.	Priority Qty
510 1, **2** (R) □Broken		/
511 1,4 (RP) □Visual Rotting		/
512 1,2,3,**4** (R) □Leaning		/
513 1,2,**3** (R) □Replace Single Arms		/
514 1,2,**3** (R) □Replace Double Arm		/
515 1,2,**3** (R) □Repair Braces		/
516 1,2,**3** (R) □Replace Braces		/
517 1,**2** (R) □Replace Anchor		/
518 1,2,**3**,4 (R) □Install Anchor		/
519 1,2,**3** (R) □Repair/Replace Guy Wire		/
521 2,**3** (R) □Tighten Guy Wire		/
522 **P** (NR) □Replace/Install Guy Shield		/
524 **4** (R) □Guy Not Bonded		/
525 1,2,**3**,4 (RP) □Lightning Damage		/
526 2,**3**,4 (RP) □Woodpecker Damage		
527 2,4 (RP) □Insects		
528 **4 (NR)** □Aerial Number Missing		/
TOWER		
531 1,**2** (R) □Tower Legs Broken		/
532 **4** (NR) □Aerial Numbers Missing		/
534 1,2,**3** (R) □Loose Bolts/Hard		/
535 **4** (NR) □Repair Anti-Climb		/
536 **F** (R) □Vegetation On Tower		/
537 1,2,**3** (R) □Structure Damage		/
538 1,2,**3**,4 (R) □Straighten Tower		/
539 1,2,**3**,4 (R) □Arms Damaged		/
POLE INSPECTION		
901 **4** (RP) □Identified Priority Pole		/
902 **4** (RP) □Identified Reject Pole		/
903 **4** (RP) □Excess Checking		/
904 **4** (RP) □Climbing Inspection Req'd		
905 **4** (RP) □No Inspection Tag		/

CONDUCTOR ** **Enter Circuit No. if More Than Circuit on Pole	Circuit No.	Priority Qty
541 1,2,**3** (R) □Conductor		/
542 1,2,**3** (R) □Static		/
543 1,2,**3** (R) □Ground Wire		/
544 1,2,**3** (R) □Sleeve/Conn.		/
546 1,**4** (NR) □Under 25 Ft.		/
LINE HARDWARE		
551 1,2,**3**,4 (R) □Insulators/Dam		/
552 **4** (R) □Insulator Plumb		/
553 1,2,**3**,4 (R) □Hardware Dam		/
555 **2** (R) □Lightning Arrestor		/
FOUNDATION – GENERAL		
563 1,2,**3**,4 (R) □Erosion		/
RIGHT OF WAY		
571 1,2,**4** (NR) □Erosion		/
572 **4** (NR) □Encroachments		/
573 **4** (NR) □Debris		/
574 **F** (R) □Danger Tree		/
575 **4** (NR) □Gate Broke		/
576 **4** (NR) □Oil/Gas Leak		/
MISCELLANEOUS		
581 4,P (NR) □Stencil/Line/ Struct No. Ground level		/
582 1,2,**3**,4 (R) □Switch Damaged		/
583 **2** (R) □Damaged Ground		/
584 **4**,**P** (NR) □Install/Replace Warning Sign		/
586 **4** (NR) □Remove Steps		/
587 **3**,4 (R) □Add Dirt & Tamp		/
589 1,**3**,4 (R) □Bird Nest		/
590 **4** (R) □Bird Perching		/
GIS		
760 **4** (NR) □GIS Map Doesn't Match Field		/
761 **4** (NR) □GIS Equip. Stenciling In Error		/
762 **4** (NR) □GIS Equip/Hardware Missing		/
763 **4** (NR) □GIS Equip. Removed In Field Remove from GIS		/
769 **4** (NR) □GIS Other GPS/GIS Errors		/

NR=Maint. Code may not directly affect reliab.
R=Maint. Code may affect reliability.
RP = Maintenance Code may affect and has specific program in place to address.

Comments on rear of sheet

Appendix B – Steel Evaluation Categories

Visual Rating 6 – Very Severe Deterioration
Perforated Element – severe physical damage

Visual Rating 5 – Significant Pitting
Significant pitting – loss of section clearly visible, edges feathered/thinned

Visual Rating 4 – Light Pitting
Some very light edge roughening. Loss of greater majority of coating and zinc layers. Corroded surface would dominate surface preparation – remedial action using wire brush, scraper and brushed paint not sufficient to give greatly increase life

Visual Rating 3 – Light Corrosion
Very light surface corrosion, majority of coating intact

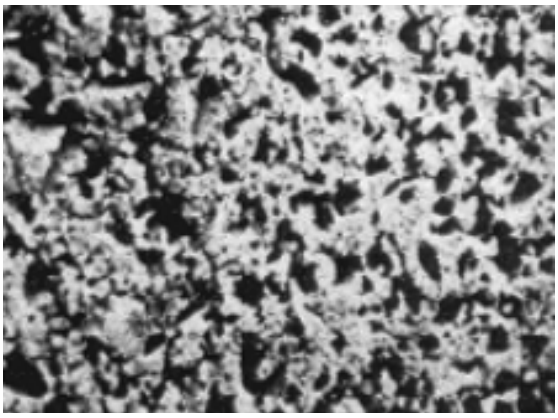
Visual Rating 2 – Intact
Paint coating over all surface – overcoat may not be intact and some very small areas (<1%) of light corrosion may be present. Galvanizing intact except for some very small areas (<1%) of light corrosion

Visual Rating 1 – Serviceable
Fully painted – overcoat and undercoat intact
Fully galvanized – coating intact

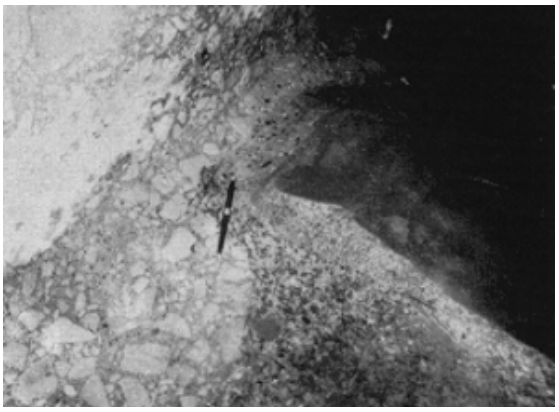
Appendix C – Concrete Evaluation Categories/Rating Matrix

Honeycombing
Construction faults, poor workmanship

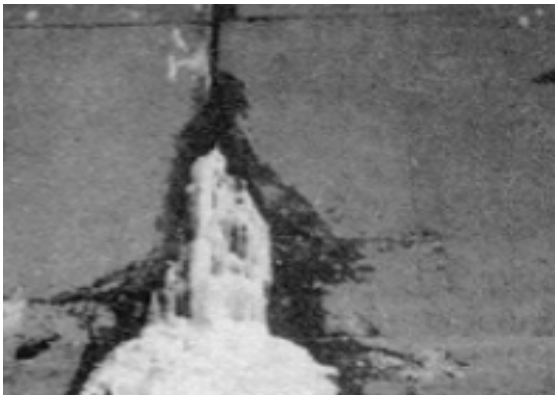
Pattern Cracking



Disintegration
Deterioration of concrete into small fragments



Erosion/Abrasion



Seepage
Movement of water or other fluids through pores

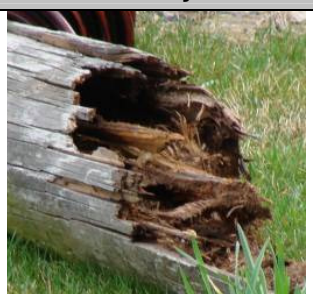
Spalling
Development of fragments

Distortion or Movement
Change in alignment of the components of a structure

Delamination
Degradation of steel/concrete interface

		Overall Foundation Rating				
		Very Severe Deterioration 5	**Severe Deterioration 4**	**Medium Deterioration 3**	**Light Deterioration 2**	**Serviceable 1**
Concrete Foundation Condition Categories	**Cracking**	Wide cracks (over 0.08" width)	Medium Cracks (between 0.04" and 0.08" width)	Fine Cracks (0.04" width)	Negligible	Negligible
	Disintegration	Very Severe Disintegration (loss of mortar and coarse aggregate at a depth greater than 0.8")	Severe Disintegration (loss or mortar between 0.4" and 0.8" around coarse aggregate)	Medium Disintegration (loss of surface mortar between 0.2" and 0.4" and exposure of coarse aggregate)	Light Disintegration (no exposure of coarse aggregate)	Negligible
	Spalling	Large spall (greater than 0.8" in depth and greater than 6" in any dimension)	Small spall (not greater than 0.8" in depth or greater than 6" in any dimension)	Negligible	Negligible	Negligible

Appendix D – Wood Poles and Structures Evaluation

Typical Pole Defects		
Bark Inclusion	**Checking (Solitary)**	**Checking (Around Periphery of Pole)**
		
The growth of the main stem around a dead branch	The separation of fibers parallel to the grain and extending towards the center of the pole	Multiple checks around entire pole circumference
Cross Break	**Mechanical Damage**	**Split**
		
The separation of fibers perpendicular or at an angle to the grain	Transportation and erection damage due to machinery such as chainsaws or cranes	The cracking of a pole due to mechanical connections or the intersection of checks
Dead Streak	**Decay**	**Decay Knot**
The growth of the main stem around the dead wood	 The softening of the pole due to fungal growth	Knots which have decayed and can extend towards the center of the pole
Pocket		
A Solitary Check, a series of checks at one location, or area of decay at the surface of the wood pole		

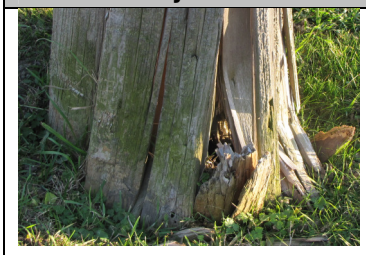
510 Pole – Broken

- Used when pole is broken due to impact, stress etc.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Damage poses significant risk of imminent failure	 Damage is not an immediate threat to the integrity of the network or to public safety	N/A	N/A

511 Pole – Visual Rotting

- Used for physical damage which compromises the strength and/or integrity of the pole (checking, dead streak, bark inclusion, cross break, decay, burning, hollow sounding pole)

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
 Damage poses significant risk of imminent failure	N/A	N/A	 All Others

512 Pole – Leaning

- Used when pole/structure is out of plumb(excludes raked angle structures which are intentionally out of plumb due to line angle)

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Leaning pole which in Inspector's judgment poses immediate and substantial threat to public safety and/or system reliability	Pole top deflection in Inspector's judgment poses a near-term risk to structure integrity	 Slope > 2" per 10' pole height	All other leaning poles

513 Pole – Replace Single Arm

• Used for damaged single arms. Arm refers to any horizontal member extending out from the main structure generally to support the conductor.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Arm damage poses immediate and substantial threat to public safety and/or system reliability	Substantial damage to cross section of arm causing the arm to deflect – failure may occur under non-extreme loading	 Appreciable damage – failure may occur under extreme loading	N/A

514 Pole – Replace Double Arm

• Used for damaged double arms.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Arm damage poses immediate and substantial threat to public safety and/or system reliability	Substantial damage to cross section of arm causing the arm to deflect – failure may occur under non-extreme loading	Appreciable damage – failure may occur under extreme loading	N/A

515 Pole – Repair Braces

• Used for damage to braces. Braces refer to intermediate members that connect parts of the structure.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Brace damage poses immediate and substantial threat to public safety and/or system reliability	Substantial damage to cross section of brace causing the arm to deflect – failure may occur under non-extreme loading	Appreciable damage – failure may occur under extreme loading	N/A

516 Pole – Replace Braces

• Used for damage to braces or missing braces. Braces refer to intermediate members that connect parts of the structure.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Brace damage or lack of brace poses immediate and substantial threat to public safety and/or system reliability	Substantial damage to cross section of brace or lack of brace causing the arm to deflect – failure may occur under non-extreme loading	Appreciable damage – failure may occur under extreme loading	N/A

517 Pole – Replace Anchor

- Used for damage to anchor rod or head or pull out of the anchor

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Guy failure poses immediate and substantial threat to public safety and/or system reliability	Anchor rod has corroded substantially or is broken, or anchor has pulled out and is no longer functioning as a structural member, or a guy should be present but is not	Appreciable damage – failure may occur under extreme loading	Superficial damage – but will not fail in 5 years

518 Pole – Install Anchor

- Used when necessary anchor is missing

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Damage poses immediate and substantial threat to public safety and/or system reliability	Damage is not an immediate threat to the integrity of the network or to public safety	N/A	N/A

519 Pole – Repair/Replace Guy Wire

- Used when a guy wire or its associated hardware, included fiberglass or wood rods, are in need of repair or replacement

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Guy failure poses immediate and substantial threat to public safety and/or system reliability	Guy is broken or seriously compromised (e.g. broken strands)	Guy is currently structurally sound, but has been compromised by corrosion, damage, etc.	N/A

521 Pole – Tighten Guy Wire

- Used when a guy wire has gone slack, as from anchor pull out, structure movement, etc.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	Slack guy is causing excessive structure deflection or overstress of other guys	 Slack guy is not causing excessive structure deflection or overstress of other guys or the structure	N/A

522 Pole – Replace Guy Shield

- Used when guy shield is damaged. Inspector should install a new one.

All Priority Level "P" Perform

524 Pole – Guy Not Bonded

- Used when guy bond is inadequate or missing

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Guy not bonded

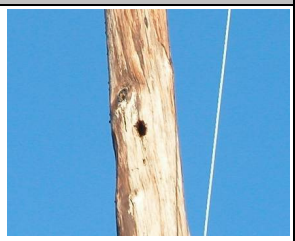
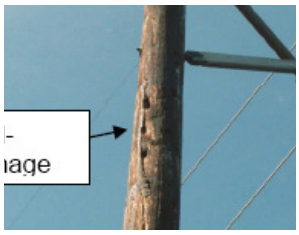
525 Pole – Lightning Damage

- Used when pole is damaged due to lightning.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Damage in Inspector's judgment poses immediate and substantial threat to public safety and/or system reliability	Non-serviceable Damage	 Serviceable Damage	Superficial Damage

526 Pole – Woodpecker Damage

- Used when pole is damaged by woodpeckers creating nests in pole

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	 Several Large (>5") Diameter Holes	 Single Large (>5") Diameter Holes	 Several Small (<5") Diameter Holes

527 Pole – Insects • Used when pole is damaged by insects			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Damage poses significant risk of imminent failure	N/A	N/A	All other noticeable damage
528 Pole – Aerial Number Missing • Used when aerial numbers are not installed where required			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
N/A	N/A	N/A	Aerial numbers are required at all road crossing, all structures ending in zero, and the first and last structures of a line.

Appendix E – Individual Wood Pole Evaluation

901 Osmose – Identified Priority Pole

- Used to document pole identified as a priority reject on Wood Pole Groundline Inspection

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	All

902 Osmose – Identified Reject Pole

- Used to document pole identified as a reject on Wood Pole Groundline Inspection

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	All

903 Osmose – Inspect Excessive Check (not reject)

- Used to document pole identified as having excessive checking on Wood Pole Ground Line Inspection

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	All

904 Osmose – Climbing Inspection Required (not reject)

- Used to document pole identified as needing a climbing inspection on Wood Pole Ground Line Inspection

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	All

905 Osmose – No Inspection Tag

- Used to document pole that has no evidence of prior Wood Pole Inspections. Not required for poles under 10 years old.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	All

Appendix F – Steel Poles and Structures Evaluation

531 Tower – Tower Legs Broken

- Used when tower legs are broken

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Leg damage which in Inspector's judgment poses immediate and substantial threat to public safety and/or system reliability	Leg damage which in Inspector's judgment poses a near-term risk to structure integrity	N/A	N/A

532 Tower – Aerial Number Missing

- Used when aerial numbers are not installed where required

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Aerial numbers are required at all road crossing, all structures ending in zero, and the first and last structures of a line.

534 Tower – Loose Bolts/Hardware

- Used loose or missing connections on hardware

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Missing connections on members in judgment of Inspector pose an immediate and substantial threat to public safety and/or system reliability	Missing connections	 Loose Connections	N/A

535 Tower – Repair Anti-Climb

- Used to repair anti-climb device

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Anti-climbing device needs repair

536 Tower – Vegetation on Tower

- Used when vegetation needs to be cleared from tower

All Priority Level "F" - Forestry

537 Tower – Structure Damage • Used for broken, bent or missing members on tower			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
 Damage in judgment of Inspector poses and immediate and substantial threat to public safety and/or system reliability	 Broken or nearly broken members	 Damage/Excessive bending on minor members	N/A
538 Tower – Straighten Tower • Used when tower is out of alignment			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Leaning tower in judgment of Inspector poses immediate and substantial threat to public safety and/or system reliability	Substantial deflection, near-term risk to structural stability	Appreciable deflection, ability of tower to sustain extreme loading conditions may be compromised	Aesthetic only
539 Tower – Arms Damaged • Used when the arms on a tower are damaged			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Damaged arms in Inspector's judgment pose an immediate and substantial threat to public safety and/or system reliability	Arm damage poses a risk of failure under routine loading e.g. a near term risk of failure	Arm damage poses a risk of failure under heavy loading	Superficial damage only

Appendix G – Conductor and Line Hardware Evaluation

541 Conductor – Bird Caging (Add comment – Bird Caging)

- Used to rate conductor bird caging.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
			
N/A	N/A	N/A	Bird Caging

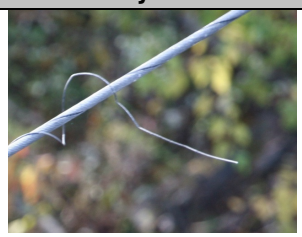
541 Conductor – Broken (Add comment – Broken Conductor)

- Used to rate conductor damage.
- Note: TLOME may revise priority levels based on an engineering evaluation of factors such as mechanical and electrical loading.

230kV and Above

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
			
Any broken conductors	N/A	N/A	N/A

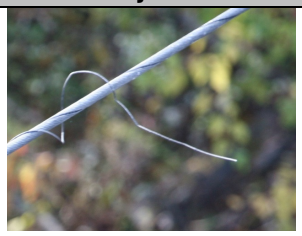
115kV and Below

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
			
Significant percentage of broken strands	Small percentage of broken strands	N/A	N/A

542 Conductor – Static

- Used to rate static wire damage.
- Note: TLOME may revise priority levels based on an engineering evaluation of factors such as mechanical and electrical loading.

230kV and Above			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
 Any broken conductors	N/A	N/A	N/A

115kV and Below			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
 Significant percentage of broken strands	 Small percentage of broken strands	Exterior damage which does not pose a near-term threat	N/A

543 Conductor – Ground Wire • Used for any damage to the ground leads on the structure			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Ground wire damage in judgment of Inspector poses an immediate and substantial threat to public safety and/or system reliability; this includes a loose ground wire near the top of the pole which may be a risk to contact the conductor	Ground wire missing or disconnected/broken on 3 or more adjacent structures	Ground wire missing or disconnected/broken on isolated structures only, or ground wire is loose near the base of the pole where there is no risk of contacting the conductor	N/A
544 Conductor – Sleeve/Connector • Used for damage to splices or connectors on the shield/static wire or conductors			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Failure in judgment of Inspector poses an immediate and substantial threat to public safety and/or system reliability	Visible physical damage to connector/splice/conductor	Visible corrosion at splice/connector	N/A
546 Conductor – Under 25 Feet • Used for substandard clearances and conductors with excessive sag.			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Conductor poses significant risk of danger to the public	N/A	N/A	General Guidelines by Voltage: • 69kV – 115kV 25 ft • 230kV – 345kV 30 ft Clearances must meet requirements of latest National Electric Safety Code, as well as local requirements (e.g. MA CMR

551 Line Hardware – Insulator Damage

- Used for chipped or broken insulators.
- Insulators that are physically separated are always Level 1

NOTE: A chipped or cracked insulator (porcelain damage does not reach more than ½ way to the center of the insulator) may not be counted as a damaged insulator if damage is not severe. This is up to the inspector's discretion.

Number of Insulators in String	Number of Damaged Insulators per String			
	Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Any	Any Physical Separation	N/A	N/A	N/A
5	2 or more	1	N/A	N/A
6	2 or more	1	N/A	N/A
7	3 or more	2	1	N/A
8	3 or more	2	1	N/A
9	3 or more	2	1	N/A
10	4 or more	3	2	1
11	4 or more	3	2	1
12	4 or more	3	2	1
13	4 or more	3	2	1
14	5 or more	3 or 4	2	1
15	5 or more	4	2 or 3	1
16	5 or more	4	2 or 3	1
17	6 or more	4 or 5	2 or 3	1
18	6 or more	4 or 5	2 or 3	1
19	6 or more	4 or 5	3	2 or less
20	6 or more	5	3 or 4	2 or less
21	7 or more	5 or 6	3 or 4	2 or less

Broken Insulators		Separated Insulators	
			

552 Line Hardware – Insulator Plumb

- Used for insulators unintentionally out of plumb

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
			
N/A	N/A	N/A	Usually a sign of high amplitude conductor movement, galloping.

553 Line Hardware – Hardware Damage • Used for any damage to other line hardware			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Hardware damage in Inspector's judgment poses and immediate and substantial risk to public safety and/or system reliability	Structural Hardware damage which poses a near-term risk to structural integrity	Structural Hardware damage, e.g. damaged connections	Cosmetic Damage
555 Line Hardware – Lightning Arrestor • Used when a lightning arrestor is damaged or has failed			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
N/A	Arrestor has failed. Lightning arrestors fail by disconnecting and falling away from the conductor	N/A	N/A

Appendix H – Foundation Evaluation

563 Foundation – Erosion • Used for any erosion around foundations			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
Erosion in Inspector's judgment poses and immediate and substantial risk to public safety and/or system reliability	Erosion is compromising structural integrity	Structure not yet at risk, but erosion appears to be progressing at a significant rate	Small erosion, may eventually become significant

Appendix I – ROW/Misc./Switch/GIS Evaluation

571 Right of Way – Erosion

- Used for any overall erosion in ROW

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Erosion exposes counterpoise and presents a significant danger to public and/or vehicular traffic	Erosion exposes counterpoise and presents a danger to public	N/A	Any other ROW erosion, i.e. washed out road or culverts

572 Right of Way - Encroachments

- Used for any unapproved use of ROW or things too close to lines

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	 Any encroachments

573 Right of Way – Debris

- Used for any debris in ROW

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Any debris in ROW blocking access

574 Right of Way – Danger Tree

- Used for any danger trees adjacent to lines

REPORT ALL TO TRANSMISSION FORESTRY

Voltage	Vertical or Lateral Clearance	
23 – 46kV	4’ or less	**All Priority Level “F” - Forestry**
69kV	6’ or less	
115kV	10’ or less	
230kV	14’ or less	
345kV	18’ or less	

575 Right of Way – Gate Broken

- Used for broken ROW gates

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Broken gate

576 Right of Way – Oil/Gas Leak

- Used for any oil, gas leaks or other foreign substances in ROW. Notify System Delivery immediately

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Oil/gas found in ROW

581 Misc – Stencil Line/Structure Number at Ground

• Used when line/structure number is missing. Inspector to stencil structure

Priority Level 1	Priority Level 2	Priority Level P	Priority Level 4
N/A	N/A	Inspector stencils number	Inspector cannot stencil number

581 Misc – Stencil Line/Structure Number at Ground

• Used when line/structure number is missing. Inspector to stencil structure.

All Priority Level "P" - Perform

582 Misc – Switch Damaged

• Used when switch is damaged

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
Visible arcing is present or condition could result in immediate failure.	Switch may fail, burning and other evidence of arcing	Switch may not be able to be operated, but likely won't fail and put the line out of service	Insignificant damage

583 Misc – Damaged Switch Ground

• Used for damaged switch grounds

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	Ground grid is exposed or lead is damaged	N/A	N/A

584 Misc – Install/Replace Warning Sign

• Used for damaged or missing warning signs. Warning signs required on both sides of all structures (2 signs total).

Priority Level 1	Priority Level 2	Priority Level P	Priority Level 4
N/A	Install warning signs at all structures that are adjacent to roads, regularly traveled pedestrian thoroughfares, or places where persons frequently gather (such as schools or public playgrounds)	Sign installed/replaced by Inspector	Install/replace signs at a low risk location where public interaction is not likely.

585 Misc – Replace Signs

• Used for missing aerial structure signs. Aerial circuit and structure ID is required on all structures at road crossings, the first and last structures of a line, and all structures ending in zero.

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Install/replace signs

586 Misc – Remove Steps

• Steps must be removed at least 10' from the ground line

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Remove steps

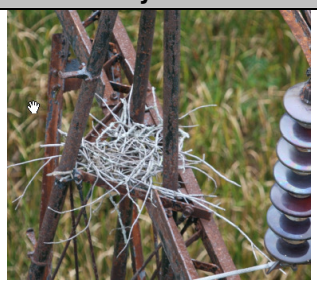
587 Misc – Add Dirt and Tamp

- Used on poles when fill dirt is insufficient

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	Structure may be weakened by absence of tamped dirt around base	 Dirt and tamping required around base of pole

589 Misc – Bird Nest

- Used when bird nests are found on line

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
 Bird nest in Inspector's judgment poses and immediate and substantial risk to public safety and/or system reliability	N/A	 Limited risk of bird contact but nest should be removed	No risk of contact such as very small nests or those at bottom of structure

589 Misc – Bird Perching

- Used when bird perching could lead to problems

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	 Birds perching on line or evidence of bird perching on line

760 GIS – Map Does Not Match Field

- Used when GIS map does not match field

Priority Level 1	Priority Level 2	Priority Level 3	Priority Level 4
N/A	N/A	N/A	Note error

761 GIS – Equipment Stenciling in Error in GIS			
• Used when equipment labels do not match GIS			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
N/A	N/A	N/A	Note error
762 GIS – Equipment/Hardware Missing in GIS			
• Used when equipment is missing on GIS			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
N/A	N/A	N/A	Note error
763 GIS – Equipment Removed in Field, Remove from GIS			
• Used when equipment has been removed in field but not on GIS			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
N/A	N/A	N/A	Note error

769 GIS – Other GPS/GIS Errors			
• Used for all other GIS errors			
Priority Level 1	**Priority Level 2**	**Priority Level 3**	**Priority Level 4**
N/A	N/A	N/A	Note error

Appendix J – Complete List of Computapole Codes

Code	Description	CAP/EXP	Default Level	Valid Levels
501	OSMOSE - Identified priority pole	C	3	2
502	OSMOSE - Identified reject pole	C	3	3
503	OSMOSE - Insp excessive check (not rej)	C	4	4
504	OSMOSE - Climbing Insp re'q (not rej)	C	4	4
901	OSMOSE - Identified priority pole	E	4	4
902	OSMOSE - Identified reject pole	E	4	4
903	OSMOSE - Insp excessive check (not rej)	E	4	4
904	OSMOSE - Climbing Insp re'q (not rej)	E	4	4
510	POLE - Broken	C	2	12
511	POLE - Visual Rotting	C	3	14
512	POLE - Leaning	E	4	1234
513	POLE - Replace Single Arms	C	3	123
514	POLE - Replace Double Arms	C	3	123
515	POLE - Repair Braces	E	3	123
516	POLE - Replace Braces	E	3	123
517	POLE - Replace Anchor	E	2	12
518	POLE - Install Anchor	C	3	1234
519	POLE - Repair/Replace Guy Wire	E	3	123
521	POLE - Tighten Guy Wire	E	3	23
522	POLE - Replace/Install Guy Shield	E	P	P
524	POLE - Guy Not Bonded	E	4	4
525	POLE - Lightning Damage	C	3	1234
526	POLE - Woodpecker Damage	E	3	234
527	POLE - Insects	E	3	14
528	POLE - Aerial Number Missing	E	4	4
531	TOWER - Tower Legs Broken	E	2	12
532	TOWER - Aerial number Missing	E	4	4
534	TOWER - Loose Bolts/Hard	E	3	123
535	TOWER - Repair Anti-Climb	E	4	4
536	TOWER - Vegetation on Tower	E	F	F
537	TOWER - Structure Damage	E	3	123
538	TOWER - Straighten Tower	E	3	1234
539	TOWER - Arms Damaged	E	3	1234
540	CONDUCTOR - Infrared Problem	E	3	123
541	CONDUCTOR - Conductor	E	3	123
542	CONDUCTOR - Static	E	3	123
543	CONDUCTOR - Ground Wire	E	3	123
544	CONDUCTOR - Sleeve/Conn	E	3	123
546	CONDUCTOR - Under 25 ft	E	4	14
547	Infrared Problem Identified	E	2	124
552	LINE HDW - Insulator Plumb	E	4	4
553	LINE HDW - Hardware Dam	E	3	1234
555	LINE HDW - Lightning Arrestor	C	2	2
556	LINE HDW - Infrared Problem	C	3	123
563	FOUNDATION - Erosion	E	3	1234
571	RIGHT OF WAY - Erosion	E	4	124
572	RIGHT OF WAY - Encroachments	E	4	4
573	RIGHT OF WAY - Debris	E	4	4
574	RIGHT OF WAY - Danger Tree	E	F	F
575	RIGHT OF WAY - Gate Broke	E	4	4

Code	Description	CAP/EXP	Default Level	Valid Levels
576	RIGHT OF WAY - Oil/Gas Leak	E	4	4
581	MISC - Stencil Lin/Struct num at ground	E	P	4,P
582	MISC - Switch Damaged	E	3	1234
583	MISC - Damaged Switch Ground	E	2	2
584	MISC - Install/Replace Warning Sign	E	4	4P
585	MISC - Replace Signs	E	4	4
586	MISC - Remove Steps	E	4	4
587	MISC - Add Dirt and Tamp	E	3	34
588	Switch - Infrared Problem	E	3	123
589	MISC - Bird Nest	E	3	134
590	MISC - Bird Perching	E	4	4
760	GIS - Map Doesn't Match Field	E	4	4
761	GIS - Equip. Stenciling In Error	E	4	4
762	GIS - Equip/Hardware Missing	E	4	4
764	GIS - Equip. Removed In Field Remove from GIS	E	4	4
769	GIS - Other GPS/GIS Errors	E	4	4

Notes

1. All Level 1 codes do not enter STORMS. The expectation is that the situation will be reported immediately, work complete within a week and a confirming work order used to track costs.
2. All Level 2 and 3 codes pass through STORMS and Design
3. All Level P codes imply that work was done by the inspector to correct defect
4. All Level F codes go to Forestry
5. All Level 4 codes are for notation only, they do not enter STORMS
6. All codes marked "E" are expense
7. All codes marked "C" are capex

Appendix 13

NG-EOP G017
Street Light Standard Inspection Program

INTRODUCTION

The purpose of this procedure is to outline the requirements for the inspection cycle for Street Light Standard installations owned by National Grid.

The inspection shall include identifying and reporting the physical condition of street lighting equipment on street lighting standards. Street lights attached to wood poles are inspected as part of the Overhead Distribution Inspection Patrol covered by NG-USA EOP D004.

All street lighting equipment will be inspected for physical damage, potentially hazardous conditions or obvious deterioration.

Inspections will be recorded on a Windows® based hand held computer. The maintenance items identified during this inspection will be separated into four priority levels 1, 2, 3, and 4. The problem codes identified default to the appropriate level. The default level can be adjusted by the individual performing the inspection based on actual field conditions.
These priority levels are defined as follows:

Level 1- An identified facility/component or tree condition that must be repaired/replaced within 1 week.

Level 2 - Identified facility/component condition that must be repaired/replaced within 1 year.

Level 3 – Identified facility/component condition that must be repaired/replaced within 3 years.

Level 4 – This priority category is to collect inventory information on actual field conditions to be used by Investment Strategy and Work Planning.

All Level 1 priority conditions identified in the field shall be called in by the Inspector as follows:

1. Notification by location:
   a. New York: contact System Operations Dispatch 1-877-716-4996.
   b. NE North: Westboro Control Center 1-508-389-9032.
   c. NE South: Lincoln Control Center 1-401-335-6075.

2. Detailed information provided to the regional notification location:
   a. Identify yourself as a Company Inspector and your work reporting area.
   b. Details of the Level 1 Priority Condition:
      i. Problem found.
      ii. District, Feeder No., Line No., Tax District and Pole No.
      iii. Street address and any additional information that would assist in finding the location of the problem.
      iv. If you are standing by or have secured the location.
3. Notification to area Inspections Supervisor for follow-up.

Equipment will be inspected on a five year cycle such that one-fifth of the inspections should be scheduled on an established annual basis.

PURPOSE

This procedure applies to all personnel involved with or responsible for the inspection and maintenance of street lighting standards and associated facilities owned by National Grid.

ACCOUNTABILITY

1. Distribution Engineering Services
   A. Update program as necessary
   B. Provide field support and training as requested.

2. Customer Operations
   A. Provide qualified personnel as the distribution inspectors, to provide consistent and accurate ` data or to contact Contract Management Services for contracting where applicable.

3. Distribution Inspector
   A. Demonstrate the ability to identify maintenance items and the aptitude to become proficient in the use of a hand held computer and desktop computer.
   B. Demonstrate the understanding and requirements of this National Grid EOP.
   C. Possess the ability to do patrols, collect information on a hand held, down load to a desktop computer, edit data, provide requested information/reports/work tickets to supervision, and track/close out work completed in the database.
      Provide qualified personnel to inspect where applicable.
   D. Ensure all inspectors have been trained.

4. Contract Management Services
   A. At the request of Customer Operations/Distribution Network Strategy obtain, schedule and manage contractors to perform inspections and perform required maintenance.

5. Network Asset Strategy
   A. Provide input into program revisions.
   B. Ensure the program as outlined in this EOP is completed each year.
   C. To develop and/or revise a five-year inspection schedule of all facilities covered by this EOP.
   D. Develop Outdoor Lighting Asset Strategy

6. Process and Systems
   A. Provide and support database.

COORDINATION

Not Applicable

REFERENCES

Applicable National Grid Safety Rules and Procedures
NY PSC Order 04-M-0159
NY PSC Order Order Adopting Changes to Electric Safety Standard, December 2008
Elevated Equipment Voltage NG-USA EOP G016

DEFINITIONS

Patrol: A walking assessment of distribution facilities for the purpose of determining the condition of the facility and it's associated components.

Hand Held Computer: A portable, self-contained electronic data recording device used to create a record of conditions found in the field.

Inspector: A qualified employee or contractor who can identify deficiencies, or non-standard construction conditions, on the Company's street light facilities.

Valid User: An individual who has been authorized to use the Street Lighting Maintenance Program by the Program Administrator.

Street Light Standard: A metallic or fiberglass shaft and arm assembly which supports street lighting luminaire(s) and associated wiring.

TRAINING

T&D Technical Training - Provide training upon request.

DOCUMENT CONTENTS

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1.0 STREET LIGHT PATROLS

Street Lighting inspections will be performed as patrols and are conducted by a street light qualified worker. The patrols are scheduled in such a manner that street lighting facilities are inspected once every five years. The Outdoor Lighting group is responsible for creating and/or revising this schedule for the respective geographic areas. The Distribution Inspector uses a Windows® based hand held computer to record employee ID, region, district, street lighting installation standard number, GPS location, Priority Level 1, 2, 3 and 4 maintenance items, and comments. The listing of these maintenance items are shown in Table I. Any new facilities added to the system will be incorporated through our Customer Service System – Outdoor Lighting (CSS-OL) database and added to the appropriate inspection cycle. The street light standards inspections scheduled for the year shall be completed by December 31st. The inspector shall place the CSS-OL street light standard number on the facility if not found numbered during the patrol.

2.0 EQUIPMENT TO BE INSPECTED AND MAINTENANCE CODES

2.1 Luminaires

2.2 Arms

2.3 Standards

2.4 Foundations

2.5 Conductor

TABLE I

PRIORITY 1, 2 and 3 MAINTENANCE ITEMS FOR OUTDOOR LIGHTING

Category	CODE	Default Priority	Description
Luminaire	300	2	Light "ON" Day
	301	2	Replace Lens
	302	4	Clean
	303	4	Paint
	304	4	Replace Wattage Label
	305	1	Wires Exposed
	306	2	Damaged - Replace
	307	4	Missing
	308	4	Other - Comments
Arm	320	2	Damaged - Replace
	321	4	Damaged - Repair
	322	4	Rust - Paint
	323	4	Other - Comments
Standard	330	2	Structure Damage - Replace
	331	4	Damaged/Leaning - Repair
	332	4	Paint/Maintenance
	333	1	Access Cover - Replace
	334	4	Bad Wiring - Repair
	335	4	Stencil Required
	336	2	Temporary Overhead *
	337	2	Ground - Repair
	338	4	Knockdown/Missing
	339	4	Other - Comments
Foundation	350	4	Damaged/Leaning - Repair
	351	4	Anchor Bolts Damaged
	352	4	Elevated - Repair
	353	4	Other - Comments

Note: The default priority of Level 4 for missing luminaries and street light standards is utilized for informational use only. If the street light standard is missing or missing a luminaire, the item shall be reviewed with records, if found to be a required and an active asset it shall be changed to a Level 1 priority.

***Refer to EOP NG-EOP G029 (Tracking Temporary Repairs to Electric System) for tracking and reporting of temporary repairs.**

3.0 STREET LIGHT MAINTENANCE DATABASE/REPORTS

The Street Light Maintenance Data Base consists of records downloaded from the hand held computers and information entered from the desktop computers. The records can be downloaded to the database through any desktop computer that is connected to the network and the inspector is logged on as a valid user of the Street Light Standard Inspection program. The desktop computer is also used to generate various reports and work tickets, depending on the user's need. These reports/work tickets are utilized to schedule and accomplish distribution maintenance work.

4.0 MAINTENANCE SCHEDULE

Maintenance activities are scheduled by priority Levels. All "Level 1 Priority" conditions identified must be repaired/corrected within 1 week. All "Level 2 Priority" conditions identified must be repaired/corrected within 1 year. All "Level 3 Priority" conditions must be repaired within 3 years. Level 4 Priority is for inventory purposes only.

Once the Street Light Patrol is completed in the Street Light Maintenance Database or 21 days have elapsed since the inspection, the Level 2 and Level 3 Priority maintenance codes are downloaded into STORMS. Expense maintenance work goes straight to scheduling while the capital work goes to Distribution Design. Level 1 Priority maintenance codes are communicated by the Distribution Inspector directly to the field operations group for the area where the feeder is located.

5.0 COMPLETION

The completion of Level 1 priority maintenance codes is performed by the field operations Supervisor or their designee. Level 2 and Level 3 priority maintenance codes are tracked in the Street Light Maintenance database and placed into the Customer Service System – Outdoor Lighting (CSS-OL) database. CSS-OL database automatically initiates a STORMS order. CSS-OL database is updated once the associated STORMS orders are complete for the work request associated with the maintenance code from the Street Light Database.

ALL MAINTENANCE WORK IS TO BE COMPLETED PER NATIONAL GRID DISTRIBUTION STANDARDS.

ALL MAINTENANCE WORK PREFORMED THAT WAS IDENTIFIED ON THE WORK ORDER OR DISCOVERED DURING THE REPLACEMENT/REPAIR/CORRECTION OF THE ORGINAL MAINTENANCE PROBLEM MUST BE LISTED ON THE DATABASE AND THEN CLOSED OUT WHEN COMPLETE

6.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	02/16/10	This document supercedes document dated 07/25/05.

Appendix 14

NG-EOP G004
Shock Complaints

INTRODUCTION

This procedure describes the requirements for investigating and reporting on a customer's shock complaint. A shock complaint is a customer call that states a person has received a shock. When investigating of a shock complaint, Company field personnel must determine if the shock was caused by faulty customer equipment, a neutral-to-earth voltage associated with the Company's distribution system, or an external DC voltage source. Regardless of the cause, a shock complaint is considered an emergency and shall be dispatched as soon as possible. The appropriate Dispatch or Control Center shall be notified of all shock incidents by the field, and all communications shall be completed as required by National Grid Electric Operating Procedure NG-EOP G009.

PURPOSE

This document details specific steps that should be followed when National Grid receives a shock complaint call.

ACCOUNTABILITY

1. Distribution Engineering Services
    A. Update procedure as necessary
2. Operations
    A. Ensure that this procedure is understood and implemented
    B. Ensure that all personal are trained in this procedure.
3. Employee
    A. Demonstrate the understanding of this procedure.
    B. Comply with the requirements of this procedure.

COORDINATION

N/A

REFERENCES

National Grid Employee Safety Handbook

National Grid Safety and Health Policies & Procedures

NG-USA EOP G003 Shock and/or Neutral-to-Earth Voltage Complaint

NG-EOP G009 Personal Injury Accidents/Newsworthy Event Reports

Metering Services Department Procedure MS505 Shock Complaint

Metering Services Department Procedure MS508 Warning Tag Electric

National Grid OH Construction Standards

DEFINITIONS

Shock Voltage: Voltage between two points that is high enough to be perceptible to people.

Primary Voltage: All distribution circuit cables or conductors energized at 4, 15, 23, or 34.5 kV.

Shall: The word shall is to be understood as mandatory.

Should: The word should is understood as recommended.

TRAINING

Provide line personnel with training, through progression schools and as necessary.

DOCUMENT CONTENTS

Table of Contents

1.0 SAFETY

1.1 All work shall be performed in accordance with the National Grid Employee Safety Handbook and all appropriate National Grid Electric Operating Procedures.

1.2 All appropriate Personal Protective Equipment including, but not limited to, hard hat, safety glasses/eye protection, rubber protective equipment, appropriate footwear and FR clothing shall be worn when performing work as required by the National Grid Employee Safety Handbook and applicable work procedures.

2.0 ORDER PROCESSING

2.1 Regardless of the cause, all shock complaints are considered an emergency order type that requires immediate dispatch. When the Customer Contact Center (CCC) receives a call from a customer stating that a person has received a shock, the CCC:

2.1.1 Immediately transfers to Dispatch any calls from 911 officials with an associated emergency or life threatening situation.

2.1.2 Retrieve the customer's account information and verify the customer's account information on the Account window.

2.1.3 Inform the customer that someone needs to be present at the premise in order for the shock complaint to be investigated. Inform the customer that their service may be disconnected if no one is present at the premise and a problem is detected.

2.1.4 Complete the Issue Investigation Order for Account or a Service Order Form (paper copy) in its entirety and fax the completed form to the appropriate dispatch office when the Customer Service System is down.

2.1.5 Call Dispatch office to verify receipt the Investigation Order or the Faxed Service Order.

3.0 INVESTIGATION

3.1 The individual investigating (generally a field service representative) a shock complaint shall:

3.1.1 Initiate Shock and/or Neutral to Earth Voltage Complaint Investigation Form NG0024 (Exhibit 1) http://infonetus/formscatalogweb/forms/NG0024.pdf

Use this form on **every** shock complaint order, even when the individual conducting the investigation resolves the problem him/herself without involving outside departments.

3.1.2 Make the first check with a National Grid approved testing device between a known ground source and the origin of the shock.

3.1.3 If the test between the ground and the shock source indicates higher than secondary voltages:

a. Safely evacuate customer(s) from the premise.

b. Contact Customer Meter Services Supervisor and System Operations Dispatch from a remote location and request Electric Operations assistance.

c. Safeguard and keep the hazardous area clear until Electric Operations provides relief.

3.1.4 If the test between ground and the source of the shock indicates secondary or lower voltages:

a. Connect an AC multi-range voltmeter (such as Fluke 87) that provides true RMS at the same location and observe the readings. Leave the voltmeter connected at this location.

b. Check for proper bonding. If additional bonding is required, assist or advise the customer accordingly.

c. Open the customer's main breaker(s)/fuse(s), remove the meter and observe the voltmeter.

1. If voltage drops to zero, the problem is within the customer's equipment.
    i. Reinstall meter and close main breaker(s)/fuse(s).
    ii. Isolate the trouble circuit by opening each breaker/fuse one at a time until the voltage reading on the voltmeter drops to zero.
    iii. Identify equipment and wiring on troubled circuit.
    iv. Isolate and disconnect troubled equipment or wiring and issue an Electric Warning Tag Form NG0023 (Exhibit 2). http://infonetus/formscatalogweb/forms/NG0023.pdf
    v. The individual conducting the investigation shall inform the customer to contact a licensed electrician or appliance repair person to check out internal wiring or appliances.
    vi. Record this information on the Shock and/or Neutral to Earth Voltage Complaint Investigation Form NG0024 (Exhibit 1).
2. If the voltage does not drop to zero, each customer on the same secondary shall be disconnected in the same manner as above. Any other customers in close proximity and with a common water supply may also have to be checked. In each case, the voltmeter should remain connected at the original complaint's premise.
3. If voltage is still present after steps 1 & 2 have been completed, it will be necessary to determine if the condition is the result of a neutral-to-earth AC source or a DC voltage. Connect the AC-DC multi-range voltmeter that provides true RMS and use the DC scale to observe readings:
    i. If DC voltage is measured, the problem is with a DC source (i.e., cable TV, telephone). Inform the customer that the problem is with a source that National Grid cannot correct or check.
    ii. Record this information on the Shock and/or Neutral to Earth Voltage Complaint Investigation Form NG0024 (Exhibit 1).
    iii. Notify Communications Companies.
4. If voltage is still present after steps 1 & 2 have been completed and the voltage is AC:
    i. Further investigation is required by the Engineering Lab in NE or the Meter and Test Department in NY as per Electric Operating Procedure G003 – Shock and/or Neutral-to-Earth Voltage Complaint.
    ii. Record this information on the Shock and/or Neutral to Earth Voltage Complaint Investigation Form NG0024 (Exhibit 1) and forward to the Engineering Lab in NE or the Meter and Test Department in NY.

EXHIBIT 1
"Shock and/or Neutral-to-Earth Voltage Complaint Investigation Report" (Form #NG0024)
http://infonetus/formscatalogweb/forms/NG0024.pdf

SHOCK AND/OR NEUTRAL TO EARTH VOLTAGE COMPLAINT INVESTIGATION REPORT

nationalgrid

Customers's Name		Phone
Street, Road, Etc.	Circuit	Pole or Enclosure
City, Town, Village		

TEST LOCATION SKETCH

VOLTAGE READINGS

CIRCUIT CONFIGURATION	A.C. Volts		D.C. Volts		CORRECTIVE ACTION
	As Found	As Left	As Found	As Left	
Normal					
Meter Removed					

REMARKS

DATE: BY:

NG0024 (11.06)

EXHIBIT 2
"Warning Notice" Form #NG0023
http://infonetus/formscatalogweb/forms/NG0023.pdf

WARNING NOTICE

TO OUR CUSTOMER

M _____

_____

In response to your request we have inspected your electrical installation and found the cause of your service failure to be as follows:

_____ Short in _____

_____ Defective _____

_____ Overlooaded Branch Circuit

_____ General Overload

_____ Over-fused Branch Circuits

_____ _____

_____

NOTE: Replacing of blown fuses will not correct the trouble listed above.

We recommend that you call your:

_____ Electrical Contractor

_____ Appliance Repairman

to make the necessary repairs.

nationalgrid

SERVICE REP _____

DATE _____

NG0023(01.06)

4.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	07/14/11	This document supersedes document dated 02/01/07.

Appendix 15

SMS 400.06.1
Substation V&O Inspection Standard

and

SMP 400.06.2
Substation Inspection Procedure

INTRODUCTION

Substation Inspection or Visual and Operational (V&O) Inspection of each Substation and Switchyard is a key element in the National Grid USA preventive maintenance program. V&O Inspections are performed with the apparatus in service and are designed to detect abnormal conditions before the apparatus is damaged or a customer outage occurs. Data collected during the V&O Inspection is one of the elements used by AIMMS to prioritize individual apparatus for complete and diagnostic inspections.

PURPOSE

N/A

ACCOUNTABILITY

N/A

COORDINATION

N/A

REFERENCES

N/A

DEFINITIONS

N/A

TRAINING

N/A

DOCUMENT CONTENTS

Table of Contents

1.0 SCHEDULE

1.1 Each transmission and distribution substation and switchyard will have a V&O Inspection at least bimonthly.

2.0 PROBLEMS AND DISCREPANCIES

2.1 Severe Trouble shall be reported to the responsible Control Center and the person in charge of the substation immediately.

2.1.1 The employee shall secure the area and warn unauthorized people to stay clear of the danger.

2.1.2 A severe trouble condition is a situation that is hazardous to the system operation and/or National Grid employees or the public.

2.2 Problems and discrepancies found should be repaired during the V&O Inspection whenever possible.

2.3 Problems and discrepancies not corrected during the V&O Inspection shall be recorded on the Inspection Card (Apparatus Inspections) or as a note in the PDA (Station V&O Inspections).

2.3.1 The Supervisor reviewing the inspection shall generate follow-up work orders to document the required work.

3.0 V&O GUIDELINES

3.1 To provide uniform and effective V&O Inspections throughout National Grid, the Substation Maintenance Standards and Procedures Books should be referenced for detailed information on the inspection of each type of apparatus.

3.1.1 Some of the typical items to be checked include: air, hydraulic and gas pressures, operation counters, oil levels and temperatures, and visual condition.

3.2 The station should be inspected for cracked or broken line terminators, bus supports and post insulators, heat discolored wire and wire terminations and blown surge arresters. All fuses and disconnects should be checked for proper seating and heat discoloration.

3.3 Alarm and communication radios operation should be verified. The telephones should be checked for proper operation.

3.4 Station Service secondary supplies should be checked alive and transfer switches checked for correct position.

3.5 Structures and foundations should be inspected for deterioration, damage and paint condition.

3.6 Substation security measures must be checked for proper operation and signs of unauthorized entry. This includes: fencing, gates, warning signs, entry alarms, locks and chains.

3.7 General substation housekeeping should also be taken care of.

4.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	12/26/06	Corrected - Formatting Changed - Header title, Document number prefix Changed - First page footer to reference Documentum Removed – Subtitle Added – AIMMS PM numbers
1.1	05/23/07	Document Added - Documentum Version # to headers Added - File name to footer
1.2	08/20/07	Problems And Discrepancies Added - Section
2.0	06/30/09	Converted to new EDO format - content unchanged

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VISUAL AND OPERATIONAL (V&O) INSPECTION

INTRODUCTION

This procedure describes the methods used to perform Visual and Operational (V&O) Inspections of electrical substations used in the transmission and distribution of electricity.

PURPOSE

V&O Inspections, are performed with the apparatus in service, and are used to:

- Verify the security of fences, gates etc. that prevent entry of the public, and provide a legal record of their inspection.
- Detect any hazards to company employees or the public.
- Verify that animal protection measures are present and in good condition.
- Detect abnormal conditions before the apparatus is damaged or a customer outage occurs.
- Collect data (counter readings, fault operations etc.) used to prioritize individual apparatus inspections.
- Collect data (regulator travels, load readings, relay targets etc.) used for system operation purposes.

ACCOUNTABILITY

Substation and other Supervisors supervising inspection and maintenance activities.

Substation and other Workers performing inspection and maintenance activities.

REFERENCES

National Grid USA Safety Handbook

SMS 400.13.1 Oil Leak Reporting Procedure

SMS 400.08.1 Trouble Reporting Procedure

EP-14 Oil Filled Electrical Equipment Management

Manufacturer's Installation, Operating, and Maintenance manuals for the specific equipment to be inspected.

Manufacturer's operating manuals for the specific test equipment to be used.

PROCEDURE CONTENTS

Table of Contents

1. Test Equipment Required.

1.1 Digital Multi-meter, IEC 1010-1 Cat. IV
  1) Spare battery

1.2 Recloser Battery test meter with load test feature.
  a) For Form 3 Recloser battery tests.

2. Materials Required.

2.1 PDA with National Grid V&O software installed.
2.2 Clipboard
2.3 Binoculars
2.4 Flashlight
2.5 Magnet for resetting drag hands
2.6 Additional items listed in Appendix A

3. Initial Substation Entry

3.1 Personal Protective Equipment.
  1) Minimum requirement is ANSI Z41/EH rated safety footwear, hard hat and safety glasses.

3.2 Vehicles entering substation.
  1) Lower and/or insure antennas will maintain minimum approach distances to energized conductors and apparatus.
  2) Use extreme caution when maneuvering to avoid hitting apparatus or violating Minimum Approach Distances.

4. Inspect Yard

4.1 Perform a quick initial inspection for:

1) Alarms.
2) Cut or removed ground grid or ground grid connections.
3) Obvious damage.
4) Security of gates, fence and locks.
5) Unusual noises.

5. Notify the System Operator

5.1 Inform them you are in the Station for a V&O Inspection and that you will be testing alarms.

5.2 Ask System Operator if any equipment has been tagged out or relays blocked.

6. Reporting and Correcting Problems and Discrepancies

6.1 Severe Trouble shall be reported to the responsible Control Center and the person in charge of the substation immediately.

1) The employee shall secure the area and warn unauthorized people to stay clear of the danger.
2) A severe trouble condition is a situation that is hazardous to the system operation and/or National Grid employees or the public.
   a) See Trouble Reporting Appendix at the end of this document for additional information on trouble reporting.

6.2 See the section Oil Leak Reporting for information on reporting oil leaks.

6.3 Document all paint and preservation problems.

1) Rust, corrosion, or fading to the point where primer, or bare metal shows.

6.4 Problems and discrepancies found should be repaired during the V&O Inspection whenever possible.

6.5 Problems and discrepancies not corrected during the V&O Inspection shall be recorded on the Inspection Card (Apparatus Inspections) or as a note in the PDA (Station V&O Inspections).

1) The Supervisor reviewing the inspection shall generate follow-up work orders to document the required work.

6.6 Record findings in the PDA if listed in the PDA “round”.

1) Record other readings or problems as Notes in the PDA
2) If performing an apparatus inspection record the V&O Inspection portion in the V&O section of the Inspection Card.

7. Control House

7.1 Check control house door locks working and in good condition.

7.2 Station Log Book

1) Enter the date, time and employee names that are performing the V&O Inspection.
2) Check the Station Log Book for abnormal conditions that can be corrected during the V&O Inspection.
   a) After the V&O Inspection, record all abnormal problems found in the Log Book, with red pen, and whether they were corrected or not.

7.3 SPCC – SPCC locations only.

1) Verify SPCC Plan is available at the substation.
2) Verify SPCC notification list posted.
3) Check oil spill containment kits complete and in good condition.

7.4 Control Panels

1) Indicating Lights
   a) Check that the indicating lights on the control board are working.
   b) Check the available stock of spare bulbs; restock as necessary.
   c) Inspect rear of Control boards for any signs of overheating, burned wiring, moisture, etc.

7.5 Noises - Listen for any unusual noises from relays, modules, RAPRs, timer circuits etc.

7.6 Relay targets and alarms.

1) Record targets and alarms on the V&O Report and in the station log book.
   a) List the apparatus affected indicating circuit designation, phase and type of relay or alarm,
2) Reset and report relay targets and alarms to the System Operator and your supervisor.

7.7 Reclosing Relays

1) Check that reclosing relays are in service.
   a) Record any reclosing relays that are off and tagged.
   b) Report any reclosing relays that are off and not tagged to the System Operator.
2) Verify mechanical reclosing relays are in the start or zero position.

7.8 Ground Trip Switches (cutouts)

1) Check that all ground trip relays are in service (ON).
   a) Record any ground trip switches that are off and tagged.
   b) Report any ground trip switches that are off and not tagged to the System Operator.

7.9 Bus Transfer Schemes

1) Check both buses alive (load ammeters, bus voltmeters bus alive lights).
2) Check timers reset
3) Check that the sequence timers in normal position
4) Check transfer scheme auto
   a) Record any auto transfer switches that are manual or off and tagged.
   b) Report any auto transfer switches that are manual or off and not tagged to the System Operator.
5) Check tie breakers properly setup (setup varies by station scheme).

7.10 High Side Transfer Schemes

1) Check both lines alive (load ammeters, line alive lights).
2) Check timers reset
3) Check that the sequence timers in normal position
4) Check transfer scheme auto
   a) Record any auto transfer switches that are manual or off, and tagged.
   b) Report any auto transfer switches that are manual or off, and not tagged to the System Operator.
5) Check air break/circuit breaker/circuit switcher status (open or closed).

7.11 Annunciator and Alarm Test Switches

1) Annunciator panel
   a) Move toggle switches, that are not tagged, to the TEST position to check lights. This will send an alarm to the Control Center.
   b) To clear trouble condition, turn the toggle switch to the reset position, then back to ON.
   c) Check with supervisor before testing any switches that are in the off position.
   d) Verify the System Operator received the alarms.
2) Test Switches
   a) If the alarm light is on perform steps b) through f).
   b) Verify the System Operator received the alarm.
   c) Open knife blades one by one and leave open until the light goes out and the alarm clears.
   d) Close the knife switches opened one at a time, checking for alarm indications.
   e) When the alarm light comes on reopen the last switch closed and continue closing the rest. This will find multiple alarms, if present.
   f) Operating the knife switches does not reset this type of alarm system. The light only stays out when the trouble condition has cleared.

3) Repair of alarm conditions.
   a) Alarm conditions should be corrected during the V&O Inspection.
   b) If the alarm condition can not be corrected during the V&O:

      The alarm should be cleared by opening the test twitch or turning the annunciator switch to OFF.

      The switch should be tagged with the date, reason and inspectors name.

      Both the System Operator and your supervisor should be notified that the alarm condition exists and the alarm point is off.

7.12 Radio Alarms
   1) Inspect condition of radio system for damage, and proper operation.
   2) If individual alarms have not been sent to the System Operator send a test alarm to from the radio cabinet.
      a) Verify the System Operator received the alarm.
   3) Make sure cabinet door is closed so the receiver voice communication is disabled.

7.13 Tags and Clearance and Control switching forms and Supplies
   1) Check the stock of Clearance and Control Tags.
      a) Restock as necessary.
   2) Check the stock of Ground Device Identification Tickets (GDIT).
      a) Restock as necessary.
   3) Check the stock of Filed Switching Order Pads
      a) Restock as necessary.
   4) Check that pens (red and blue/black) and pencils are available.
      a) Restock as necessary.

7.14 Control House Heating and Lighting
   1) Test control house lighting.
      a) Replace any defective bulbs, or ballasts or sockets.
   2) Test emergency lighting.
      a) Replace batteries if needed
   3) Inspect heaters, fans and thermostats for proper operation. Make sure fans are not broken or bound up and they are in good working order.

7.15 Station Service and Transfer Switch
   1) Check transfer switch on preferred supply
   2) Check transfer switch for damage or overheating.
   3) Test and record preferred and alternate secondary voltages at transfer panel.

7.16 Check AC supply panels for:
   1) Tripped circuit breakers.
   2) Circuit breakers in the proper position.

7.17 Check DC Circuit Breaker of Fuse Panel
   1) Check DC supply panels for:
      a) Tripped circuit breakers or blown fuses.
      b) Circuit breakers in the proper position.

7.18 Protective Grounds
1) Check that grounds in station are in sets of 3 and that they are hung up properly.
2) Check that the phase end and ground clamps are in good working order.
3) Lubricate as required.
4) Inspect for the cracked or cut insulation and broken conductor strands.
5) Replace or repair damaged protective grounds. Do not leave damaged grounds at the station.

7.19 Switch Sticks
1) Inspect Switch Sticks and Grounding Sticks for current dielectric test date.
   a) Send out of date sticks to lab for testing or;
   b) Test locally using approved methods, test equipment and competent, trained personnel.
2) Inspect Switch Sticks and Grounding Sticks for surface contamination, damage and proper operation.
   a) Clean if necessary
3) Insure Switching and Grounding Sticks are stored properly.

7.20 Fire Equipment
1) Inspect fire extinguishers to be properly secured and in their marked locations.
2) Update inspection cards.
3) Record out of date fire extinguishers on the V&O and record for future replacement.
4) Discharged fire extinguishers shall be reported to the appropriate supervisor for recharging.
5) Discharged or partially discharged fire extinguisher shall be removed from the substation.

7.21 Phone Lists
1) Verify local and regional System Operator phone numbers are posted and correct.
2) Verify that the emergency telephone list is posted and clearly visible at each telephone location.

7.22 Cleanliness and General Condition -
1) Clean control house floors and sanitary facilities, empty wastebaskets and dust as necessary.
2) Inspect control house for water leaks.
3) Check for signs of animal entry into control house.

7.23 Turn on yard lights, so they can be checked during the Yard Inspection.

8. Yard Inspection

8.1 Unusual Noises
1) Be alert for arcing, gurgling and pinging noises which could indicate imminent and violent equipment failure.

8.2 Walk the fence and inspect:
1) Barbed wire - Strands to be intact and tight.
2) Fence fabric - Holes or breaks in the chain link.

3) Fence Ties - Loose or missing fence tie wires.
4) Fence Erosion - Signs of erosion or digging under the fence.
   a) Space below fence should be less than 3 inches.
5) Grounding - Ground conductor and connections secure and connected at every other fence post. Posts on both sides of gates should be grounded.
6) Fence Posts – Sound, not rusted through at ground level and not been raised by frost.

8.3 Gates
1) Test gates for proper operation.
   a) Gates should swing easily out of the way.
2) When closed, the gates should by chained tightly, or locked, with minimal space.
3) Verify locking chains, hardware and locks present and in good condition.

8.4 Check for proper “Danger High Voltage” warning signs:
1) Every 50 feet along perimeter of fence.
2) On gates and on non-hinged side of gate. (see National Grid Standard #0105)

8.5 Substation yard security problems shall be corrected or reported immediately to supervisor.

8.6 Vandalism related problems should be specifically recorded as such, and reported to supervisor.

8.7 Yard Lights
1) Check all yard lights working. (Yard lights should have been turned on during control house inspection.)
2) Repair broken bulbs, glass fixtures, spot light heads, or other lighting that needs attention.
   a) If work cannot be completed safely and while maintaining safe work clearances or if special equipment such as a bucket truck is needed, note on the V&O report.

8.8 Vegetation
1) Check for any growth of trees or vegetation in fence and gate areas that animals or people could used to climb over the fence.
   a) Cut or record for the Arborist to have removed.
2) Record vegetation growth within the substation that requires spraying or removal.

8.9 Bus and structure.
1) Record missing or damaged animal protection devices.
2) Inspect insulators for:
   a) Broken, chipped or damaged skirts.
   b) Carbon tracking or flash over.
   c) Surface contamination (dirt, rust, salt spray etc.).
   d) Broken or damaged insulators should be recorded on V&O Report.
3) Broken porcelain should be picked up off the ground.
4) Visually inspect current and voltage transformers for damage or signs of overheating.
5) Visually inspect arresters for:
   a) Blown or damaged arresters
   b) Surface contamination

6) Visually inspect potheads and cable terminators for:
   a) Damage and leaking compound.
   b) Surface contamination
7) Report unusual noises immediately and record them on the V&O Report.

8.10 Structure and apparatus ground connections
1) Inspect for any cut, broken or missing ground connections to apparatus, structures and guy wires.
2) Inspect static wires and record any problems.
3) Visually Inspect Station Service Transformers for:
   a) Evidence of oil leaks on transformer tank, and on the ground.
   b) Bushing damage or surface contamination.
   c) Damaged or improperly closed primary fuses.
   d) Output Voltage if not previously measured at station service transfer switch.

8.11 Inspect equipment and structure foundations.
1) Large cracks.
2) Settling (not level).
3) Deterioration (large areas of surface erosion, stone showing).

8.12 Inspect Cableways

8.13 Damage, missing or broken cover sections and deterioration.

8.14 Inspect buildings junction boxes, structures etc. for overall paint condition
   a) Record items needing attention.

8.15 Clean up substation yard.
1) Remove broken porcelain, debris, and trash
2) If area requires major clean up or crushed stone requires leveling, note on V&O Report.
3) If equipment or materials are intentionally stored in the yard insure that they are neatly placed and not a hazard to personal. Barricade area if necessary.
   a) Storage should be in compliance with SMS 499.10.1 Substation Work Area Identification Procedure.

9. Oil Leak Reporting

9.1 Oil filled apparatus must be inspected for any signs of leaks.
1) The oil leak status shall be recorded for each piece of oil filled apparatus that has an oil leak screen in the PDA.
2) Leaks from small apparatus that do not have an oil leak screen in the PDA should be recorded in a PDA notes screen.

9.2 Oil Leak Status Codes
1) Oil leaks are categorized as follows:
   a) Unknown – Unknown is used to indicate that no information has been entered in AIMMS for this equipment.
   b) Clean - Apparatus is dry and shows no evidence of oil leaks.

c) Repaired – A leak is found and repaired, note the repairs made.
d) Weep - Anytime the external surface of a piece of apparatus is wet with oil. Note the location and, if possible, cause of the leak.
e) Leak - Oil is running off or about to run off the external surface of containers or electrical apparatus. Required Action

9.3 Leaks categorized as Leak require immediate action to stop the leak or contain the released oil.

9.4 All leaks require creation of a Leak Report Work Order.

1) When the supervisor reviews the V&O inspection work order round screen all leak status changes and notes will show up as exceptions.
2) The Supervisor will then create a Leak Report Work order (Type LR) in Work Order Tracking or Quick Reporting.

9.5 Leaks from PCB Equipment

1) If a leak is discovered from equipment classified as over 500 ppm PCB cleanup must begin within 48 hours (40 CFR 761.30(a)(1)(x).
2) The inspection records must also include:
   a) The location of the leak;
   b) The estimate of fluid released;
   c) The date and description of any cleanup, containment, repair or replacement;
   d) The results of any containment (for example, was containment successful or not).
   e) The daily inspection results required for uncorrected, active leaks (refer to Environmental Procedure EP-14).
   f) The records must be available for inspection by the EPA and must be maintained for at least three years after disposal of the equipment.

10. Apparatus Inspections

Refer to the V&O Inspection sections of the following SMS's for apparatus inspections.

Circuit Breakers

SMP 401.01.2 – Air Magnetic Circuit Breaker Maintenance Procedure
SMP 401.02.2 – Oil Circuit Breaker Maintenance Procedure
SMP 401.03.2 – Vacuum Circuit Breaker Maintenance Procedure
SMP 401.04.2 – Air Blast Circuit Breaker Maintenance Procedure5
SMP 401.05.2 – Two Pressure Gas Circuit Breaker Maintenance Procedure
SMP 401.06.2 – Gas Puffer Circuit Breaker Maintenance Procedure
SMP 401.07.2 – Station Recloser Maintenance Procedure
SMP 401.08.2 – Vacuum Switch Maintenance Procedure

Transformers

SMP 402.01.2 – Power – 15 MVA and above Maintenance Procedure
SMP 402.02.2 – Power – Below 15 MVA Maintenance Procedure
SMP 402.03.2 – Dry Type Transformer Maintenance Procedure

Instrument Transformers
- SMP 403.01.2 – Currents, Potentials and Metering Maintenance Procedure Voltage Regulators
- SMP 404.01.2 – Step Voltage Regulator Maintenance Procedure
- SMP 404.02.2 – Induction Voltage Regulator Procedure

Emergency Generators
- SMP 405.01.2 – Emergency Generators Maintenance Procedure

Batteries & Chargers
- SMP 406.01.2 – Lead/Acid Battery Maintenance Procedure
- SMP 406.03.2 – Static Changers Maintenance Procedure

Sensing Devices
- SMP 407.01.2 – Bushing Potential Device Maintenance Procedure
- SMP 407.02.2 – Coupling Capacitors and CCVTs Maintenance Procedure
- SMP 407.03.2 – Wave Trap Maintenance Procedure
- SMP 407.04.2 – Resistive Coupled Potential Device Maintenance Procedure

Capacitors
- SMP 408.01.2 – Station Capacitor below 69kV Maintenance Procedure

Disconnect Switches
- SMP 409.01.2 – Disconnect Switches Maintenance Procedure
- SMP 409.02.2 – Circuit Switchers Maintenance Procedure
- SMP 409.03.2 – High Speed Grounding Switch Maintenance Procedure
- SMP 409.04.2 – Gas Insulated Disconnect Switch Maintenance Procedure
- SMP 409.05.2 – Gas Insulated Ground Switch Maintenance Procedure

Load Tap Changer
- SMP 412.01.2 – Load Tap Changer Maintenance Procedure

Reactors
- SMP 413.01.2 – Dry Type Reactor Maintenance Procedure
- SMP 413.02.2 – Oil Filled Reactor Maintenance Standard

Metal Clad Bus and Switchgear
- SMP 417.02.2 – Metal Clad Bus, Switchgear and Substation Maintenance Procedure

Surge Arresters
- SMP 419.01.2 – Surge Arrester Maintenance Procedure

Network Protectors
- SMP 421.03.2 – Network Transformers and Protectors Maintenance Procedure

11. Final Checklist

11.1 Turnoff yard lights
11.2 Verify all abnormal conditions found are entered in station log book.
11.3 Call the System Operator and notify them that the V&O Inspection has been completed and you will be leaving the station.
    a) Report any abnormal conditions, alarms or relay targets found.
11.4 Turn control house lights off and lock doors.
11.5 Re-arm security alarms.
11.6 Close and securely lock gate.
11.7 Turn in completed V&O Inspection Report to supervisor.
11.8 Return PDA to cradle and upload Station Inspection “round”.

12. Appendix A. - Additional Materials

Not all of the listed items will be required in all areas. It is suggested that the items required for a particular area be stocked in the vehicle used for V&O Inspections or a large container that can be taken when inspections are to be done.

12.1 Cleaning Supplies
    1) Broom and dust pan
    2) Rags
    3) Trash bags
12.2 Repair and Maintenance
    1) Shovel
    2) Ladder
    3) Electrical tape
    4) Small hand tools
12.3 Personal Protective Equipment
    1) Acid resistant gloves
    2) Face Shield and Apron
12.4 Station Supplies
    1) Spare Station Log Books
    2) System Operator (phone number) cards
    3) Spare operations counter cards
    4) Pen, pencils and erasers (red pencil for trouble)
    5) Clearance and Control Tags
        a) Red Tags
        b) Non-Reclose Assurance (NRA) Tags
        c) Hold Tags
        d) Station Control (SCT) Tags
        e) Worker Placards
    6) Ground Device Identification Tickets (GDIT)
    7) Clearance and Control Switching forms

12.5 Security Supplies
- 1) Spare Padlocks Locks:
  - a) Long shank 5105873
  - b) Short shank 5105872
- 2) Chain for gates
- 3) Fence tie wire
- 4) Fence fabric
- 5) Warning signs 0810029

12.6 Indicating Lamps and Lenses:
- 1) Switchboard. LED (Red) S/C 5100183
- 2) Lens Cap (Red) S/C 5695322
- 3) Switchboard. LED (Green) S/C 5100184
- 4) Lens Cap (Green) S/C 5695321
- 5) Switchboard. LED (Amber & White) S/C 5100185
- 6) Lens Cap (Amber) S/C 5695320
- 7) Lens Cap (White) S/C 5100186
- 8) Switchboard Lamp 24EX S/C 5844590
- 9) Switchboard Lamp 145 Volt, 15W S/C 5841410
- 10) Indicating Bulb type 49 S/C 5843078
- 11) Indicating Bulb type 47 S/C 5843100
- 12) 18 Volt Miniature 0.11A Automotive S/C 5843110
- 13) Indicating 35V, .06A S/C 5843132
- 14) Indicating type 43A S/C 5843250
- 15) Switchboard Lamp 24X S/C 5844610
- 16) Switchboard Lamp 55C S/C 5844630
- 17) Indicating Lamp 120 P.S.B. S/C 5841359
- 18) (for V.S.A. Reclosers)

12.7 Incandescent Lamps:
- 1) Incandescent Lamp 75 Watt S/C 5841739
- 2) Incandescent Lamp 100 Watt S/C 5841840
- 3) Incandescent Lamp 135 Watt S/C 5842001
- 4) Incandescent Lamp 200 Watt S/C 5842150
- 5) Mogul Base Lamp 500 Watt S/C 5842390Flood lamp PAR 38 100 Watt S/C 5842045
- 6) Fluorescent Lamps:
- 7) 8 FT Single Pin Lamp 75 Watt S/C 5841050
- 8) 4 FT Bi - Pin Lamp 40 Watt S/C 5840950
- 9) 4 FT Single Pin Lamp 40 Watt S/C 5840940
- 10) 8 FT Recessed Pin Lamp 105 Watt S/C 5841130

12.8 Spare emergency light batteries
12.9 Spare fuses
12.10 Recloser control and trip fuses
    a) Reclosers often use time delay fuses that are similar in appearance to AGC types. If the wrong type fuse is installed it will blow after a couple of operations.
2) Cartridge fuses
    a) 5A
    b) 10A
    c) 15A
    d) 20A
    e) 30 A
3) AGC Fuses
    a) 2 A slow blow and instantaneous
    b) 5A slow blow and instantaneous
    c) 10A slow blow and instantaneous
    d) 20A slow blow and instantaneous
12.11 Spare nitrogen bottles
12.12 Battery Supplies
    a) 5 Gallon distilled water and battery filler S/C 5599778
    b) Battery NO SMOKING Signs S/C 5483448
    c) Extra hydrometer S/C 5474448
    d) Extra thermometer S/C 487304
    e) Baking Soda
    f) Spare eyewash bottles S/C 5890600
    g) Nylon brush to clean battery posts
    h) Battery grease
12.13 Spare recloser batteries

13. Appendix B – Trouble Reporting

13.1 Trouble

1) The term trouble is defined as any condition which occurs on the equipment that has or could affect the ability of that equipment to perform its required function.

13.2 Severe Trouble

1) A severe trouble condition is a situation that is immediately hazardous to the system operation and/or personnel. These troubles are immediately reported to the System Operator and to the person in charge of the substation. The employee shall secure the area and warn unauthorized people to stay clear of the danger.
2) Examples of Severe Trouble
   a) Dead station battery
   b) Blown bushings or cable terminator
   c) Downed live lines
   d) Multiple broken support insulators
   e) Electrical fires
   f) Grounds cut in station
   g) Loss of station service power
   h) Broken pole or structure
   i) Blown by pass/shunt arresters on regulators
   j) Low oil levels
   k) Unusually noises

13.3 Not Immediately Fixable Trouble

1) These troubles are reported to the System Operator and the person in charge of the substation. They shall also be noted on the V&O form and station logbook in red and scheduled for repair at a later date.

13.4 Examples of Not Immediately Fixable Trouble

   a) Surge Arrester blown
   b) Broken operating rods on disconnects
   c) Damaged bus support insulators

13.5 Fixable Trouble

1) Fixable items should be repaired as they are discovered during the V&O Inspection. This insures that the station is maintained in the best possible operating condition and prevents unnecessary return trips. The items fixed should be noted on the V&O Report and in the station logbook.
2) Examples of Fixable Trouble
   a) Low Battery electrolyte
   b) Replacing blown lamps
   c) Changing filters
   d) Installing missing covers

e) Installing signs
f) Repairing holes in fence
g) Installing new locks
h) Cleaning and repairing oil leaks
i) Tightening compressor belts
j) Changing recloser batteries
k) Replacing control fuses
l) Changing nitrogen bottles
m) Changing Silica Gel turned pink or white
n) Cleaning and repairing leaks

14. Record of Revisions

Revision	Changes
08/20/2007	Reporting Changed – Section name to Reporting and Correcting Problems and Discrepancies Revised – Section extensively revised Materials Required Removed - Substation V&O Inspection Report form, Inspection Report from last V&O Inspection, Substation V&O Checklist form.
09/30/2007	Switch Sticks Added - or; Test locally using approved methods, test equipment and competent, trained personnel.

Appendix 16

NG-EOP G029
Tracking Temporary Repairs to Electric System

INTRODUCTION

The purpose of this procedure is to outline the steps to be taken when a temporary repair is made to the electric system to restore service or maintain public safety until a permanent repair can be made. Every effort should be made to make permanent repairs within 90 days. For those rare exceptions when permanent repairs are not made within 90 days, special reporting and periodic site visits are required to monitor the temporary repairs until the permanent repairs are completed.

PURPOSE

This procedure applies to all personnel who are responsible for initiating temporary repairs along with employees who are responsible for designing, planning, scheduling and construction of permanent repairs made at locations where temporary repairs were made to restore service or maintain public safety.

ACCOUNTABILITY

1. Distribution Engineering Services
    A. Update procedure as necessary.
2. Customer Operations
    A. Ensure the components of the procedure are implemented.
    B. Ensure workers are trained in this procedure.
    C. Provide revision input as necessary.
3. Workers
    A. Demonstrate the understanding of the procedure.
    B. Comply with the requirements of the procedure.
4. Inspections
    A. Ensure components of this procedure are implemented.
    B. Track temporary repairs identified by Inspections
    C. Provide periodic inspections of temporary repairs greater than 90 days.
    D. Compile and submit report to PSC.

COORDINATION

Not Applicable

REFERENCES

State of New York Public Service Commission Order 04-M-0159
State of New York Public Service Commission Order 04-M-0159 Adopting Changes to Electric Safety Standards Effective December 15, 2008.

DEFINITIONS

Confirming Work Request: Any emergency work completed in the field, does not require scheduling and is not billable to a 3rd party.

Level 9: This priority category is used when a temporary repair is identified in the field by Inspections.

Non-confirming Work Request: Any emergency work not completed in the field, requires scheduling and is not billable to a 3rd party.

Permanent Repair: Repaired in accordance with National Grid Standards.

Property Damage Claim: Billable emergency work.

TRAINING

Provided by appropriate National Grid training program.

DOCUMENT CONTENTS

Table of Contents

1.0 TEMPORARY REPAIRS MADE BY OPERATIONS

Temporary repairs that are made by operations to restore service or maintain public safety until permanent repairs can be made; are recorded by Distribution Support Services utilizing a pre-formatted form that will require all pertinent information needed in order for the Temporary Repair to be entered into the Maintenance Database. The form will then be e-mailed to a 'group' mailbox that the Inspections Department Administrative staff will be authorized to access. Information from the attached form will be used by the admins to enter the Temporary Repair into the Maintenance Database with the appropriate maintenance code, and assigned a priority of Level 9. The Level 9 would indicate that this a temporary repair that should be completed within 90 days. Maintenance codes assigned a Level 9 will be downloaded from the maintenance database nightly into STORMS. Level 9 codes associated with a maintenance item will be assigned directly to Scheduling to be scheduled within 20 business days. Level 9 codes that require design will be downloaded from maintenance database and placed in the work queue for the Distribution Design Supervisor or Engineering Supervisor for the appropriate area. Scheduling will have 20 business days to schedule the Level 9 work request to the field for completion.

2.0 TEMPORARY REPAIRS DISCOVERED BY INSPECTIONS

Temporary repairs located by Inspections during an inspection are to be recorded in the Maintenance Database with the appropriate maintenance code and with an assigned priority Level 9. The Level 9 would indicate that this a temporary repair that should be completed within 90 days. Maintenance codes assigned a Level 9 will be downloaded from the maintenance database nightly into STORMS. Level 9 codes associated with a maintenance item will be assigned directly to Scheduling to be scheduled within 20 business days. Level 9 codes that require design will be downloaded from maintenance database and placed in the work queue for the Distribution Design Supervisor or Engineering Supervisor for the appropriate area. Scheduling will have 20 business days to schedule the Level 9 work request to the field for completion.

3.0 TEMPORARY OVERHEAD REPAIRS (TOH)

Temporary overhead repairs (TOH) are utilized by operations to restore service while the underground cable that generally serves the facilities is being repaired. TOH's that meet National Grid Overhead Standards for construction would not be considered a temporary repair that would need to be tracked under this procedure. TOH's not meeting National Grid Overhead Standards for construction are required to be tracked under this procedure as a temporary repair and follow the process outlined in paragraph 1 above.

4.0 TEMPORARY REPAIRS NOT COMPLETED WITHIN 90 DAYS

Every effort should be made to complete temporary repairs within 90 days. In extraordinary circumstances, which may include major storms, where repairs may extend beyond 90 days (exceptions), the company shall periodically perform site visits to monitor the condition of the temporary repairs. The company shall also report these exceptions as part of the reporting requirements outlined in the State of New York Public Service Commission Order 04-M-0159 Adopting Changes to Electric Safety Standards Effective December 15, 2008.

The Inspections group is responsible for tracking all temporary repairs that extend beyond 90 days. The initial periodic inspection should take place after 90 days and every 45 days until the permanent repair is made. The Inspection supervisor should run a report from the maintenance database for open Level 9 codes. The periodic inspection time frame lines up with the periodic inspection requirements for the elevated voltage findings requirements and could be run at the same intervals.

It is strongly encouraged that these temporary repairs be completed as soon as practicable to limit the burden of tracking these repairs.

5.0 NYS PUBLIC SERVICE COMMISSION REPORTING

Temporary repairs that are beyond 90 days must be identified and justified as part of the reporting requirements of the PSC Orders referenced below. The 90 days time period commences on the day the temporary repair was made or the day the temporary repair was located. Inspections will be responsible for consolidating the temporary repair information from operations and from the maintenance database in order to prepare the report that will be submitted to the PSC. The report will identify the temporary repairs that exceeded 90 days, the periodic site visit information and the justification for the repair taking longer than 90 days. Inspections shall file the report by February 15 each year.

6.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	05/07/10	This is a new document.

Appendix 17

Asset Management Summary of Audit

Operations Performance QA/QC Summary of Audit Report

AUDIT CATEGORY	(X)
Technical	
Supplier / Subcontractor	
QA / Other	X
Environmental	
H&S	

AUDITOR(S): David Donovan, Mike Carroll, Debra Au, Michele Decaire, Joseph Tirocchi

AUDITEE(S): Transmission Line Inspection and Maintenance Program – Annual Audit required by NYS PSC Case No. 04-M-0159

AUDIT OF: T Line Inspection and Maintenance per NYS PSC
AUDIT DATE: 1/1/2011-12/31/-2011

AUDIT CARRIED OUT AT: NY Transmission Right-of-way field sites and Syracuse Headquarters.

ACTIVITY/SYSTEM AUDITED : Transmission Line Inspection and Maintenance Program – Annual Audit required by NYS PSC Case No. 04-M-0159

AUDIT SUMMARY: The purpose of this audit is to demonstrate compliance by National Grid's Transmission Line of Business with the requirements of the New York State Public Service Commission Case 04-M-0159 noted in the December 12, 2008 order. In Appendix A, Section 5, entitled, Quality Assurance, specific details are delineated as shown below:

"*Each utility shall develop a quality assurance program to ensure timely and proper compliance with these safety standards. The quality assurance program shall be independent of the stray voltage testing and visual inspection programs. The management and personnel performing quality assurance activities shall be separate from those performing the required stray voltage testing and inspections.*

...(a) with regard to inspections, the quality assurance program should ensure that inspections are being performed on all facilities and that deficiencies are being properly identified and categorized for repair. The program should also verify that permanent repairs are made and the timeliness of the repairs."

This audit report summarizes the steps taken by Operations Performance QA/QC to monitor and review the process used and the field results obtained by both the NY Inspection Group as well as the Transmission Work Delivery organization. It should be noted that the Operations Performance QA/QC Group is managed separately from both the NY Inspection group and the Transmission Line Construction Group. This audit review specifically included NY transmission line assets from 115kV and above.

OBSERVATIONS / BEST PRACTICE / PROCESS IMPROVEMENTS / LEARNING POINTS:

Quality Assurance (QA) Process:
Step One of the annual QA process is a review of the Transmission Line data within the Inspection program (Computapole) database. The transmission line data is reviewed for accuracy in two ways. The data for each line is reviewed to ensure that the Foot Patrol Complete field is complete showing when the line was last inspected, and secondly, the Foot Patrol Schedule field is reviewed to check that the next scheduled inspection is set for five years out from the last patrol date to ensure future scheduling accuracies. Any issues identified by the auditor are then reviewed and corrected in the Computapole database by the NY Inspection group based on research performed by their division personnel.

Step Two of the annual QA process involves a field review of a sample of inspection findings prior to actual field correction. In order to audit the maintenance code selection and priority code assignment done by the NY Inspection field personnel, the sample sites are selected randomly throughout the year from the Computapole database to ensure a good representation of that calendar year's inspection data. These sites are then field reviewed by the auditor. The field findings are reviewed against the current version of the Transmission Line Maintenance Procedure document, PR:06.01.601.001, Ground Based Visual Inspection.
Any questionable findings are also reviewed with the Inspections group to determine if the inspector and/or the inspection system have set the appropriate Maintenance Code and Priority Levels. Deficiencies found are addressed as an action item and reviewed either at an inspector training exercise held by the NY Inspection group at the beginning of each inspection year or through distribution of a communication to all inspectors.

Step Three, much like Step Two, involves a field review of a sample of inspection findings but in this case after they have been reported as repaired in the field. The sample sites are also selected randomly throughout the year from the Computapole database. These sites are then field reviewed by the auditor for repair completeness and appropriateness. Any misreported completion findings are reviewed with the Transmission Construction organization. Deficiencies found through the audit are addressed as an action item and assigned to the appropriate National Grid organization for root cause and corrective action.

Step Four includes the quarterly review of Level 1, 2, 3 and 9 (temporary repair) response timeliness. Each quarter, NG Inspections and Maintenance Compliance Group provides metrics on the number of records identified, completed, open and overdue for each level of finding. These metrics are provided directly to the PSC Office of Electric, Gas and Water. For the Transmission Line of Business, Level 1 is to be completed in 1 week, Level 2 in 1 year, Level 3 in 3 years and Level 9 used for temporary repairs is targeted for repair in 90 days. The metrics are provided by NG I & M Compliance Group can be reviewed at the monthly Operations Performance Group (OPG) meeting. At the OPG meeting, action items for updates on overdue inspection response cases are assigned.

Reporting the Results: The results of the quality assurance audits as described in the four steps above are incorporated into a final audit report. As mentioned above to ensure that the auditor's findings are accurate all are reviewed by the appropriate National Grid organization. That review process also sets the appropriate action items for any non-compliant findings. Next, a final draft version of the audit report and action items is reviewed within the appropriate National Grid operations group to ensure the appropriate level of attention to the findings and action items. Action items are monitored for timely and accurate completion by the Operations Performance QA/QC Group through a formal tracking database. The audit report is included as part of the Annual PSC Stray Voltage Testing and Inspection report to the NYS PSC.

Calendar Year 2011 Findings:

1. **Step One – Computapole Data**
    a. All Transmission lines with overhead conductors were found to be contained in the Computapole database. Of the six hundred-fifty-three records reviewed, all were shown to have a date of when the last foot patrol was performed. The next scheduled inspection was also confirmed to be set five years out from the last patrol.

2. **Step Two – Inspection Review** – Maintenance Codes and Priority Levels

A sample size of nineteen sites was reviewed in the field.

a. Identified (4) Computapole records with incorrect priority codes. All misidentified priority codes were in reference to the identification of the number of damaged insulators allowed per string per procedure PR.06.01.001. **Refer to Exhibit A table, number 1.**

ACTION ITEM: NY Inspections Group to review the Transmission Maintenance Procedure document PR.01.601.001 with all Transmission Inspectors. The focus will be on the proper identification and coding for the number of damaged insulators per string

Assigned to: Inspections Group (Marc Courtney,Central & Brian McMaster, Eastern Region)
Due Date: 2/2012 Central
4/2012 Eastern

b. Identified (2) Computapole records with incorrect maintenance codes. The misidentified maintenance codes were not in line with the listing of computapole codes as referenced in procedure PR.06.01.001 Appendix J. **Refer to Exhibit A table, number 2**

ACTION ITEM: NY Inspections Group to review Transmission Maintenance Procedure document PR.01.601.001 with all Transmission Inspectors. The focus will be on the use of handheld devices and proper coding from the drop down menu on the field units.

Assigned to: Inspections Group (Mat Payton. Eastern Region) Due Date: 4/2012

3. **Step Three – Field Completions**

A sample size of twenty one sites was reviewed in the field.

a. Identified (2) work completed Computapole records that work was not performed in field. **Refer to Exhibit A table, number 3.**

1. Maintenance code 501 is for osmose. Computapole stated a C-Truss was installed. Field audit determined work was not complete.

ACTION ITEM: NY Vegetation & Maintenance Management Group to review and train data analysts on the proper procedure for entering field data into system. The focus will be on the field data supplied by 3rd party contractors and entered into system by NG analyst.

Assigned to: NY Vegetation & Maintenance Management Group (Nick Gibson, Eastern Region)
Due Date: 7/2012

2. Maintenance code 551 is for insulator damage. Computapole stated work completed. Filed audit determined work has not been completed and 1 damaged insulator out of a string of 9 still exists.

ACTION ITEM: NY Transmission Line Construction Group to review procedure PR.06.01.001 with NG field Supervisors and 3rd party contractors performing actual work. Emphasis will focus on the field data supplied by 3rd party contractors and the proper process of checks and balances for confirmation of completed work.

Assigned to: Transmission Line Construction Group (Bill Murty,Western Region) Due Date: 4/2012

Exhibit A

2011 QA/QC Audit Findings:

- **Grade: Satisfactory**
- **Action Items: Noted Below**

Number	Deficiency	Action Required	Priority	Assigned to	Due Date
1	Identified (4) Computapole records with the incorrect priority codes	NY Inspections Group to review Transmission Maintenance Procedure document PR.01.601.001 with all Transmission Inspectors	M	Inspections Group (Marc Courtney, Central Region Brian McMaster, Eastern Region)	Central Region February 2012 Eastern Region April 2012
2	Identified (2) Computapole records with incorrect maintenance codes	NY Inspections Group to review Transmission Maintenance Procedure document PR.01.601.001 with all Transmission Inspectors along with use of handheld devices	M	Inspections Group (Brian McMaster Eastern Region)	Eastern Region April 2012
3	Identified (2) work completed Computapole records that were not performed in field	NY Vegetation & Maintenance Management Group to review and train data analysts on the proper procedure for entering field data into system. NY Transmission Line Construction Group to review procedure PR.06.01.001 with NG field Supervisors and 3rd party contractors performing actual work	M	NY Vegetation & Maintenance Management (Nick Gibson, Eastern Region) Transmission Line Construction Group Bill Murty, Western Region)	NY Vegetation & Maintenance Management July 2012 Transmission Line Construction Group April 2012

4. **Step Four – Inspection Response Timeliness** (1/1/11 thru 12/31/11)

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Transmission				
Transmission Facilities	**2011**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Total				
Number of Deficiencies	**25**	**339**	**2574**	**7**
Repaired in Time Frame	24	55	56	3
Repaired - Overdue	1	0	0	3
Not Repaired - Not Due	0	284	2518	1
Not Repaired - Overdue	0	0	0	0

a. The reporting of Level I response times shows that with the exception of only one, all Level I repairs were completed within 1 week as required per procedure PR:06.01.601.001

b. The metrics for Level II response times show that of the 339 deficiencies found, there are no overdue repairs with calendar year 2011.

c. The metrics for Level III response times show that of the 2,574 deficiencies found, there are also no overdue repairs for calendar year 2011. The 2,518 assets not repaired yet still fall within the 3 year window for completion per procedure PR:06.01.601.001

d. 2010 was the first year of formal tracking of temporary repairs found or made in the field. The company developed a process for managing the temporary repairs as Level 9s through the Computapole application. Metrics on Level 9 findings show 43% have been repaired on time, 43% have been repaired but missed the 90 day window and 14% not repaired still fall within the 90 day window.

Signatures of:	**Date:**
QA/QC Manager: _____	2/7/2012
QA/QC Specialist: _____	
PROCESS OWNER: _____	2/7/2012
Mgr. Asset Management - Transmission	
CIRCULATION:	

Appendix 18

Certifications

CERTIFICATION
[STRAY VOLTAGE TESTING]

STATE OF NEW YORK)
) ss.:
COUNTY OF ALBANY)

Keith P. McAfee, on this 15 day of February 2012, certifies as follows:

1. I am the Vice President, Maintenance and Construction, New York Electric, of Niagara Mohawk Power Corporation d/b/a National Grid (the "Company"), and in that capacity I make this certification for the annual period ending December 31st, 2011 (the "Twelve-Month Period") based on my knowledge of the testing program adopted by the Company in accordance with the Public Service Commission's Orders issued and effective January 5, 2005, July 21, 2005, December 15, 2008, and July 21, 2010 in Case 04-M-0159 (collectively the "Orders"), including the Quality Assurance Program filed by the Company with the Commission.

2. In accordance with the requirement of the Orders, the Company developed a program designed to test (i) all of the publicly accessible electric facilities owned by the Company ("Facilities") and (ii) all streetlights located in public thoroughfares in the Company's service territory ("Streetlights"), as identified through a good faith effort by the Company for stray voltage (the "Stray Voltage Testing Program").

3. I am responsible for overseeing the Company's Stray Voltage Testing Program.

4. I hereby certify that, to the best of my knowledge, information, and belief the Company has implemented and completed its Stray Voltage Testing Program for the Twelve Month Period. Except for untested structures that are identified as temporarily inaccessible in the Company's Annual Report, submitted herewith, the Company is unaware of any Facilities or Streetlights that were not tested during the Twelve-Month Period.

5. I make this certification subject to the condition and acknowledgement that it is reasonably possible that, notwithstanding the Company's good faith implementation and completion of the Stray Voltage Testing Program, there may be Facilities and Streetlights that, inadvertently, may not have been tested or were not discovered or known after reasonable review of Company records and reasonable visual inspection of the areas of the service territory where Facilities and Streetlights were known to exist or reasonably expected to be found.

Keith P. McAfee

Sworn to before me on this 15th day of February, 2012

Notary Public:

LISA A. PRICE
Notary Public, State of New York
No. 4989305
Qualified in Albany County
Commission Expires Dec. 2 2014

CERTIFICATION
[FACILITY INSPECTIONS]

STATE OF NEW YORK)
) ss.:
COUNTY OF ALBANY)

Keith P. McAfee, on this 15 day of February 2012, certifies as follows:

1. I am the Vice President, Maintenance and Construction, New York Electric, of Niagara Mohawk Power Corporation d/b/a National Grid (the "Company"), and in that capacity I make this certification for the annual period ending December 31st, 2011 (the "Twelve-Month Period") based on my knowledge of the inspection program adopted by the Company in accordance with the Public Service Commission's Orders issued and effective January 5, 2005, July 21, 2005, December 15, 2008, and July 21, 2010 in Case 04-M-0159 (collectively the "Orders"), including the Quality Assurance Program filed by the Company with the Commission.

2. The Company has an inspection program that is designed to inspect all of its electric facilities on a five-year inspection cycle, as identified through a good faith effort by the Company ("Facilities"), in accordance with the requirements of the Orders (the "Facility Inspection Program").

3. I am responsible for overseeing the Company's Facility Inspection Program.

4. I hereby certify that, to the best of my knowledge, information, and belief the Company has implemented and completed its Facility Inspection Program to inspect approximately 20 % of its Facilities during calendar year 2011, in order to comply with the five-year inspection cycle required under the Orders.

Keith P. McAfee

Sworn to before me on this 15th day of February, 2012

Notary Public:

LISA A. PRICE
Notary Public, State of New York
No. 4989305
Qualified in Albany County
Commission Expires Dec. 2, 2014